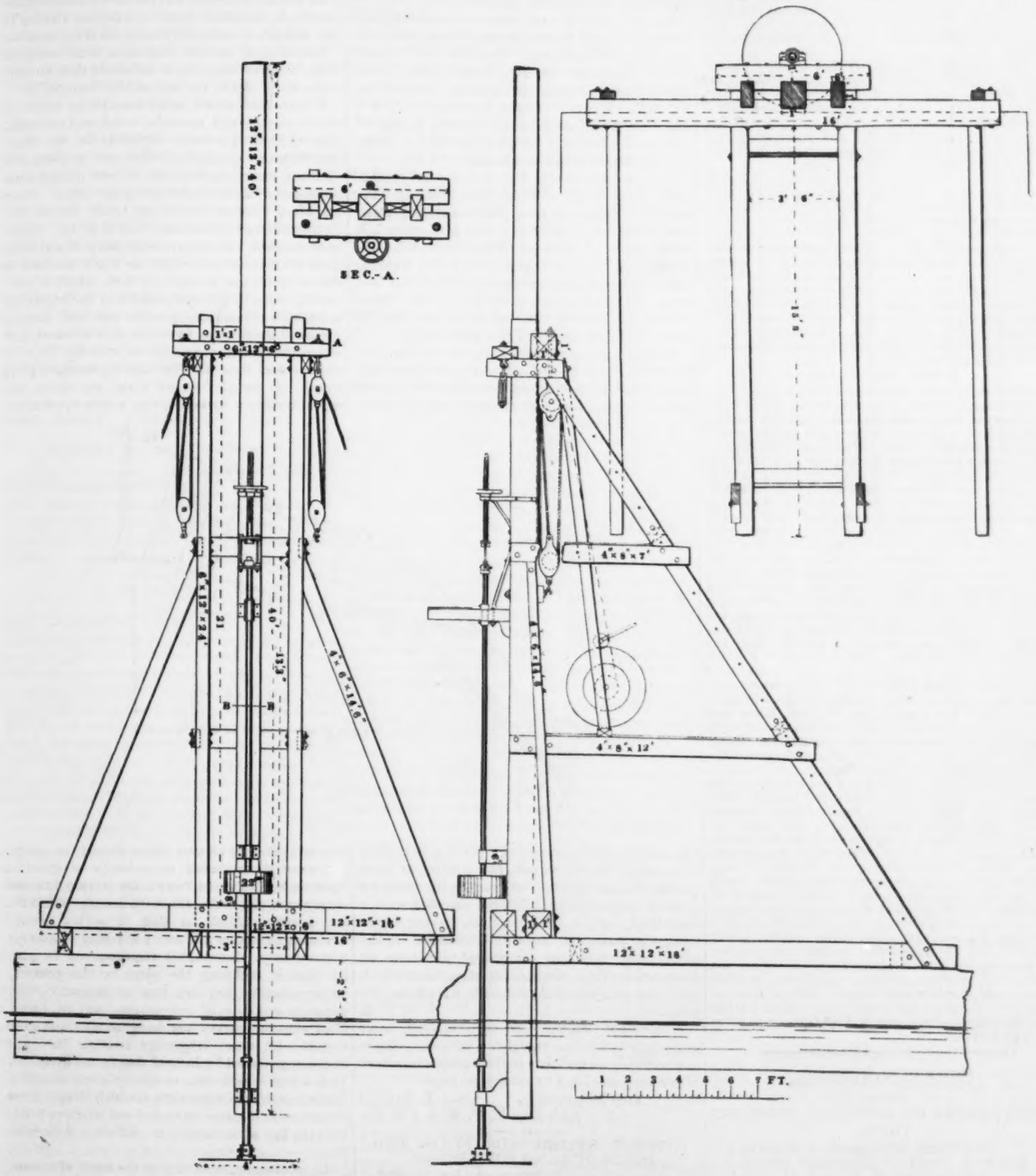
MACHINE FOR CUTTING OFF PILES UNDER WATER.

In answer to several inquiries, we present this week an illustration of the only design for this purpose we had on hand at the time. Since the present plate was made, we have been kindly offered complete details of a more modern machine, embodying the latest improvements—a machine which has just been used by Clarke, Reeves & Co. in preparing the foundations for the new bridge at Albany, N. Y. Through the courtesy of Thos. C. Clarke, C. E., of the above firm, we will be enabled very soon to give our readers complete drawings of this later design.

The present illustration needs but little explanation, the principal feature is a horizontal saw, with a shaft driven by a 22in. belt wheel. The shaft works in cast iron sleeves attached to central vertical timber slipping in guides, at top and bottom of frame. This latter stick is moved up and down by means of a fall and winch shown on the side elevation, the two falls shown on end elevation are only for guying purposes, a 3ft. adjusting screw sets the saw more exactly. It can be worked either from a float or from a stationary track.



MACHINE FOR CUTTING OFF PILES UNDER WATER

RECLAMATION OF FLORIDA LANDS.

The reclamation of lands in the southern portion of the peninsula, by affording an outlet for the waters of that vast inland sea, known as Lake Okeechobee, has been a mooted question for years, but no decisive step was taken in that direction until January, 1881, a few weeks after the present administration came in. At that date, Colonel I. Coryell appeared before the Board of Trustees of the Internal Improvement Fund, as the representative of Philadelphia capitalists and negotiated a contract with said Board for the drainage and reclamation of lands lying south of township 24 in consideration of receiving one-half of the lands so reclaimed. The last Legislature chartered the "Atlantic and Gulf Coast Canal and Okeechobee Land Company," who have succeeded to all the rights under said contract.

This company immediately had a series of surveys made to test the practicability of the proposed undertaking, and from their surveys, as well as those made by the United States, under the direction of General Gilmore, it was shown that Lake Okeechobee has an elevation of twenty-two feet above the Gulf of Mexico, and that Lake Tahopekaliga, the head waters of the Kissimmee River has an elevation of sixty-five feet above the waters of the Gulf. These facts being ascertained, the company assumed the practicability of reclaiming this vast area, amounting to many million acres by drawing off the waters and preventing the periodical overflows. The work was commenced by

...ing powerful steam dredges on the Caloosahatchee river and Tahopekaliga lake, the plan of operations being to open a canal from the Caloosahatchee river to Lake Okeechobee and the cutting of a canal from Lake Tahopekaliga through to Kissimmee river, and the cutting of one or more canals from Okeechobee to the Atlantic Coast, as as well as the construction of subsidiary canals. The dredge upon the Caloosahatchie entered Lake Okeechobee on the 21st of December last. This marks an important event in the history of the State.

The work has been quietly but steadily pushed forward, one of the conditions of the contract being that the work should be continuous and with a force equal, at least, to the labor of one hundred men. Up to Dec. 1, 1882, the company report that they have expended $93,777 and had constructed over twelve miles of canal, twenty-two to thirty-five ft. wide and five to six ft. deep.

The early completion of the first series of canals is already assured, which, in addition to the reclamation of the lands, will afford a great inland system of steamboat navigation from Kissimmee City through the Caloosahatchee to the Gulf of Mexico, a distance of 180 miles. The magnitude of this enterprise and its destined influence upon the future of the State can scarcely be realized. The reclamation of many millions of acres, containing some of the most valuable sugar lands in the United States, with suitable climatic conditions for the successful growth of all tropical fruits, is the harbinger of an era of population, wealth and prosperity unthought of in our past history.

EAST COAST CANAL.

The feasibility of forming an inland water communication from the mouth of the St. Johns River to Biscayne Bay, in the extreme southern portion of our State, a distance of some 270 miles, by utilizing the waters of Pablo Creek and North Matanzas, Halifax and Indian Rivers, has long been conceded. It took practical shape when Col. I. Coryell and Hon. John Westcott organized, under the General Incorporation act, the "Florida Coast Line Canal and Transportation Company," with a capital of $500,000. Active operations were commenced in November last by the construction of a suitable steam dredge which was carried from St. Augustine to the south end of Matazas River, where it commenced operation, and has already cut a canal 30 feet wide and averaging over 6 feet deep from near the line of township 9 south, range ten east, to the mouth of Matta Compra Creek, a distance of some four miles. A cut through the marsh borders of Matta Compra Creek for a distance of three and a half miles due south and a distance from that point of one mile in an easterly direction, makes the connection with Smith's Creek which flows south into Halifax River and forms the connection which gives steamboat navigation at the lower end of the lagoon to the "Haul-over," where a cut of less than a mile gives the desired entrance into Indian River.

The importance of this great improvement has long been acknowledged and cannot be well overrated. The Trustees of the Internal Improvement Fund appreciating this, withdrew the lands belonging to the fund along the route for the benefit of the enterprise. If the evidences of the earnestness and vigor manifested by the company having the work in charge are omens of the future, it will not be long before that entire tropical section of our State will be supplied with transportation, and a large population gladden and render productive the splendid lands adjoining those various water courses. Even in its isolated condition the number of thriving settlements along the route attest the value of the various locations. And thus another great enterprise has been inaugurated, as illustrative of the progress and development made in the last two years.—*From Message of Governor Bloxham of Florida.*

CORRESPONDENCE.

MEASUREMENT OF DIFFICULT CROSS-SECTIONS.

NEW YORK, WEST SHORE & BUFFALO RAILWAY, ASSISTANT ENGINEER'S OFFICE, NEWBURGH, N. Y., JAN. 12, 1883.

EDITOR ENGINEERING NEWS:

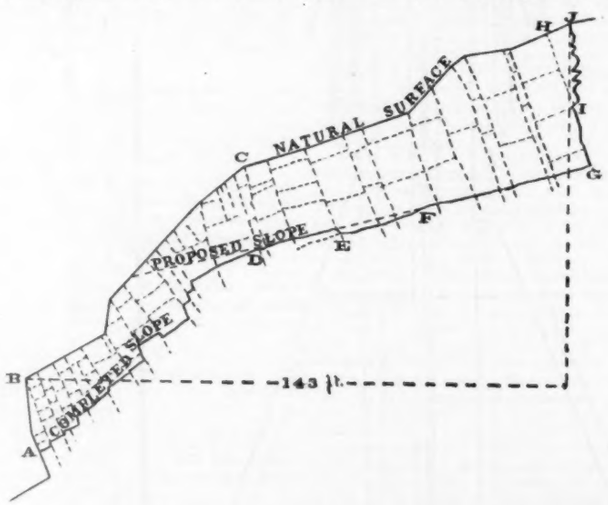
The article by Mr. Isaaci which appeared in your issue of Dec. 2 seems to show such a misapprehension of the difficulties encountered in Hudson River rock work that a further reference to the subject may not be out of place.

Let us use, for purposes of illustration, the subjoined cross-section, which is the middle section of a side cut 800 ft. long found on the Newburgh Division. This cut is made through a hard and brittle limestone, similar to much of the rock met with in this vicinity, which occurs in well-defined strata of varying thickness up to 15 ft. and having a dip of about 12 degrees. The strata are broken by seams and natural joints nearly at right angles to the rock beds and found most frequently and in the greatest irregularity at the angles and tops of the natural slopes. When seen in plan the nearly vertical seams lie in two sets of parallel planes, sometimes indistinctly traceable, which intersect at an angle of about 150 degrees.

It is obviously almost impossible to work such a section exactly to any proposed slope line, or by any system of benching. The method of regular benches suggested by Mr. Isaaci would prove especially inapplicable to a cut like the one from which Mr. Mowry's section was taken, where it was desired that most of the material be wasted, without intermediate handling, in order to hasten the completion of the excavation.

In the section shown, firm rock was not reached until the area *A B C D* had been removed. The rest of the slope was then trimmed along the proposed slope line, excepting that a distance hole broke back of the slope at *EF* as illustrated. The presence of the seam which caused this breaking back was not ascertained until the blast had been fired. On reaching the grade level it was found necessary to remove the rock above the bed *GH* and to break off the triangular point *HIJ*.

We have, in our practice found it necessary for the information of the contractor, to frequently mark points in such slopes, sometimes running up from the center with tape and slope rod and sometimes down from a convenient, previously marked slope point. In determining the position of these points, we have had the best success by using for vertical measurements a tall rod plumbed with a hand level, and, at the same time, having a tape hooked to its top for horizontal distances. It has occasionally been very convenient to measure up and mark heights on a derrick mast, from which they are easily transferred with a level to any point.



Is there not, among your older readers, some engineer who has had experience with steep slopes and will give his methods to the younger members of the profession in a letter to your paper?

Very Respectfully, CHAS. B. BALL,
Ass't Eng. N. Y. W. S. & B. Ry.

UNIFORM SYSTEM FOR PLATS AND DEEDS OF LAND FOR RECORD.

AKRON, O., Jan. 15, 1883.

EDITOR ENGINEERING NEWS:

In your issue of the 13th Mr. Le Baron presents some arguments in favor of a uniform system of descriptions for deeds, and uniform requirements for land plats. While I have spent several years in land surveying, I never realized how large a percentage of recorded deeds were imperfect, erroneous and indefinite until I made the plats and maps for the appraisal of real estate of Summit County. In doing this I examined many hundred records, and think that a majority were faulty and many grossly so. While there can be no doubt that a reform is needed, it will be useless to ask any legislation which will seriously impede transferring real estate. His system presupposes a survey of each piece before the deed is executed. The law here does not require this, and should not. It would not only make transfers more costly in many cases, but would often cause serious delay and loss.

In March, April and May our surveyors often are months behind their work, and parties wishing to buy and sell cannot always wait on their motions.

But even if all his conditions were complied with, the deed might be so indefinite that no surveyor could plat it, nor any auditor transfer it.

What a deed should contain is data by which it can be platted and contents found, and secondly, data which shall serve to definitely fix the lines. Townships are generally divided into sections and quarters, tracts, surveys, lots or some similar divisions, one set often subdividing the other. These are often further divided by roads, streets, etc. Hence follows several requirements he has entirely overlooked. First, give after the political divisions the sections or divisions in which the land is situated with the acreage in each which is conveyed. Secondly, give the position of the beginning point with reference to nearest side and nearest corner of the division in which it is situated, and where lines intersect or coincide with the lines of any division, state it. His first requirement gives length of lines. I would make the third, but would modify it by saying that a close approximation will often be all that can or should be given, as "about 90 ft. being one-seventh of grantors front on Market street," or on the section line one surveyor might make the total length 630.25 ft., and another 629.95, so that it is not always advisable to tie down to any particular figures for it too closely. Fourth, his requirements to give the angles enclosing the piece or the courses, stating whether they are true or magnetic with variation and date, of course can only be partly filled when no survey has been made; and even then it is far more important to state how the lines are governed by lines of streets and divisions. Thus a line which runs northerly along a section line is better than a description which simply gives the course, and leaves us to find out whether it follows the line of the section or differs a little from it.

His recommendation to give the kind of instruments and tapes, or chains used may serve some useful purpose, but it seems to me it is a somewhat remote one and hardly compensates for lumbering up the deed; and certainly would not add anything to the dignity of the surveyor.

Too much importance can not be given to the recommendation to describe the monuments. Where we wish a boundary to be fixed or governed by such an object as a wall or fence, it should be specified as passing through or along some definite part of it. If we wish the courses and distances to govern we must not mention these objects. Temporary objects like most fences should seldom be mentioned therefore. Where a boundary is a

ditch, canal, brook or river the deed should, as he says, state whether the center or side line is intended.

His next requirement leaves out our lake and river fronts entirely and only provides for fronts on the sea. I would suggest that where one boundary is on navigable water it should specify at what stage the water is taken or whether it follows dock or harbor lines. Traverses of these boundaries should be given with the statement that the traverse is approximate and a further statement of what the real boundary is. Lines which are circular or part of any geometrical figure can be given correctly without much difficulty.

These requirements, however, are all arbitrary and I believe that a deed calling for "one acre in a square form bounded by south and west lines of section 10," is definite enough for either auditor or surveyor. Hence, I cannot agree that it is either right or expedient to require more of a description than shall be necessary for correctly platting and placing the area and to enable the surveyor to find with ease and certainty the lines designated. Whether it fulfills even these conditions can generally only be known by an expert, and all deeds should pass through the hands of a competent surveyor having authority to reject any which do not fulfill them when they could reasonably be filled. Respectfully

T. D. PAUL.

Resident Engineer, Public Works of Ohio.

WEIGHT OF IRON BRIDGES.

DENVER, Jan. 17, 1883.

EDITOR ENGINEERING NEWS:

Will some of your numerous readers give me some information about the determination of the approximate weight (dead load) of iron street bridges? Respectfully, FR. EITEL, C. E.

BOOM DERRICK.

EDITOR ENGINEERING NEWS:

Allow me to criticise your very good cut of a derrick in ENGINEERING NEWS for Jan. 13. Why do you want such a heavy mast? 22 in. at butt and 16 at head is a very large stick, even for a 65 ft. length. You have a single 14 in. block lashed on to the boom several ft. below the end. Why not cut a mortise through the boom nearer the end and put a good sheave in this mortise? Your main hoisting fall (from stone to outer end of boom) is 4½ in. rope, while the back fall (from stone to mast-head) is but 3½ in. rope. In the position of the weight as shown, the back fall has to sustain as much of the weight as the main fall, and it has but three parts, while the main fall has four. Why not make the back fall 4½ in. rope, and use a double block at the lower end of it and take the end of the fall to the engine instead of fastening it to a cleat; then put the cleat on the boom and fasten the end of the boom-fall to this cleat? Then you show a single 18-in. sheave mortised into the mast-head, and the double block of the back fall secured by lashing several feet below the mast-head. I would have two sheaves, one on each side of the mast instead of the single 18-in. sheave, and take the main fall over one of them and the back fall over the other. I would attach the double block of the back fall to a wrought-iron band clamped around the mast just below the two sheaves. Get the attachments as near the end of mast and boom as possible, so as to make the length of your spars available. I believe you can handle a heavy stone more easily by keeping the boom at one height and using the main fall and back fall at the engine than by the rig shown in the illustration.

You speak of the danger of the mast pin dropping down. This could only occur by the hole being bored too deep for the pin, a piece of gross carelessness, but the pin may work out. I would have a hole through the mast pin near the lower end, and, after the pin is in position, bore a hole through the mast and put a bolt through mast and mast pin. Then the pin will neither drop down nor work up. Put a hole through the top of mast pin with a split key to keep spider down. I think all your ropes are too large except the guys, and they are not long enough for a 65-ft. mast. The ironwork at the bottom of the boom is not strong enough. There should be a good stout cast-iron socket for the foot of the boom to rest on, and the straps and pins would only have to keep it in position. You don't need that little single block at the mast-head to hoist rigger. He can go up on the hoisting fall.

There! I've found so much fault that I'm sorry I commenced to write. It is a very good idea to illustrate and describe contractors' plant. Some of them have wretched apparatus and don't seem to know that better can be made. Can't you give us a cut of a smaller derrick, say with a 30 or 40 ft. mast? I have found a 30-ft. mast very convenient for railroad work as it could be loaded on one flat car.

Give us some more illustrations, even if they don't exactly suit *me*. T. APPLETON.

[We find that our "Derrick" of Jan. 13 has already answered one of the very points we had in view in illustrating it, and thank Mr. Appleton for his able and, in some points, just criticism. We want the opinions of just such men as Mr. A.: and as he has evidently studied the subject from a very practical standpoint, we would suggest, for the benefit of our many readers, that he send us for publication a complete drawing of the class of derrick he has found best in his practice, and let it be the 30-ft. mast railroad derrick.

As mentioned, the derrick illustrated was built and used some fourteen years ago in actual construction of heavy work, and answered its purpose very well; but it evidently can be improved upon, and we want to bring out these improvements.

In regard to dimensions of mast and falls we might say the mast was cut down from a 72-ft. stick, used on heavier work; as to the back-fall, only single-drum hoisting engines were used, making his suggestions impossible; we purposely avoided cutting into mast or boom whenever a block lashed on the stick would answer the purpose in view. The key through gudgeon-pin, answering as it does two purposes, is better than the collar, though the writer never had any trouble from the pin working out. The boring of the hole too deep is undoubtedly "gross carelessness," but of a kind that *will* happen sometimes in practice, and should be guarded against by all possible expedients. We expect very shortly to illustrate in detail a set of derricks of the very latest date and construction, which will not be open to so much objection as our first, built as it was, before the present improved hoisting machinery was in common use.—EDITOR ENGINEERING NEWS.]

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page 27.*)

CCCCLXXI.—BRIDGEPORT.

Bridgeport, Connecticut, in lat. 41° 10′ 30″ N., long. 73° 11′ 46″ W., on an inlet of Long Island Sound, at the mouth of Pequonnock River, is mostly on a small plain, behind which rises Gold Hill, about 60 ft. high, and occupied by residences.

The town was set off from Stratford in 1800, it was incorporated a borough in 1820 and a city in 1836.

The first water-works were constructed in 1818 by the Rev. Elijah Waterman, who cleaned out and deepened several springs on the south side of Gold Hill, and conveyed water from them in wooden pipes to the business part of the town. In 1823 Lewis Seger purchased the works and enlarged and extended them, taking in more springs, and supplied water until 1848, when the works were purchased by C. B. Hatch. In 1853 Nathaniel Greene procured a charter from the city, and formed a company which constructed a reservoir of two acres area, and holding 10,000,000 gallons, on a hill 80 ft. above the city, and pumped water to it from the Pequonnock River, and laid pipes in the city. They issued bonds to the amount of $90,000, and not being able to meet them at maturity, the works were sold under foreclosure in 1857, and the Bridgeport Hydraulic Company was formed, which introduced a gravity supply from Island Brook and Ox Stream. On the former a storage reservoir of 80 acres, and on the latter, one of 50 acres was formed by earth dams, the water being conveyed to the distributing reservoir by cement-lined wrought-iron pipe. In 1878 a storage reservoir was built on the Pequonnock River about 6 miles from the city, 175 ft. above tide level, of 50 acres area, 10 ft. deep, and holding 180,000,000 gallons. The water is conveyed to the distributing reservoir in a 16-in. pipe.

In extreme droughts, the steam pump of 16 in. bore and 48-in. stroke is used to keep up the supply from the river.

Distribution is by sixty miles of pipes of from 20 to 4 inches diameter. Cement lined wrought-iron was first used. Cast-iron is now used. There are 187 fire hydrants, 200 gates and 3,500 taps, and one metre. The city pays $7,500 per year for hydrants. Lead and wrought iron service pipes are used.

The population in 1880 was 27,643. The consumption in 1882 was 2,500,000 gallons.

The capital stock of the company is $400,000. The works have cost $800,000. The bonded debt is not given. The expenses in 1882 were $25,000 and the receipts $50,000.

C. M. Thorp is the Secretary and George Richardson the Superintendent.

CCCCLXXII.—SALEM, VA.

Salem, Virginia, in lat. 37° 15′ N., long. 80° 15′ W., is near the Roanoke River in a valley on a spur of the Blue Ridge.

It was incorporated a town in 1832.

Water-works were built by the town in 1876, after plans of L. Morrison, taking the supply from a copious spring and pumping it by a steam pump into a small reservoir excavated in clay and lined with cemented brick, holding 250,000 gallons at 50 ft. above the town.

Distribution is by three miles of cast-iron pipe of from 8 to 3 in. diameter, with 12 fire hydrants 2 gates and 118 taps. Service pipes are of wrought iron.

The population in 1880 was 1,759. The daily consumption in 1882 was 7,500 gallons.

The works have cost $12,817.26. The bonded debt is $10,500 at 8 per cent. interest. The expenses in 1882 were $207.97 and the receipts $803.80.

Trouble has been experienced from the freezing of the pipes which are not laid deep enough.

The works are managed by the Town Council. James P. Boon is the superintendent.

CCCCLXXIII.—ST. JOHNS, N. F.

St. Johns, Newfoundland, in lat. 47° 34′ N., long. 52° 45′ 10″ W., is on a high hill side, sloping up quite steeply from the harbor to a height of 225 ft. The town was settled about 1623, and the first post-office in Newfoundland was established there in 1805. Water-works were first built in 1847. Of these, no statistics are furnished. In 1862, a corporation, the stock of which was guaranteed by the government at 5 per cent., constructed works after plans of R. Forman, C. E., of Glasgow, and under superintendence of J. Fenwick and C. Martin, taking the supply by gravity from Windsor Lake, which has a watershed of 20 square miles and an area of 2 square miles. Three small dams of earth, puddled and faced with stone, raise the water 9 ft. above its natural level. The lake is 4½ miles from and 500 ft. above the town, to which the water is conveyed in a 16-in. cast-iron pipe. In 1874 the first half mile from the pond was replaced by 24-in. pipes.

Distribution is by 9 miles of cast-iron pipe, the sizes of which are not given. There are 124 fire hydrants and 1,500 taps. Service pipes are of lead, ½ in., of 5 lbs. per yard.

The population in 1880 was 30,743. The daily consumption in 1881 was 3,500,000 gallons.

The works have cost $520,000. The expenses in 1881 were $48,111 and the receipts $46,870.

The works are managed by three directors appointed by the government. Theodore Clift, one of the directors is the secretary and John Martin the engineer.

CCCCLXXIV.—GILROY, CAL.

Gilroy, California, in lat. 37° 2′ N., long. 121° 30′ W., is in a level valley between the Contra Costa and Coast Ranges of Mountains, which approach to within half a mile of each other at the southern end of the valley.

Settled in 1850 it was incorporated a city in 1868. Water-works were built in 1872 by a private company organized by Donald McKenzie and D. S. K. Buick, taking the supply from Uvas Creek a small stream rising in the Coast Range. A dam across the stream diverts the water into a flume 18 ins. square, of hard wood lumber, which conveys it 6 miles, and it is then conveyed 3 miles in wrought-iron pipe of 17 to 13 ins. diameter to a reservoir 2½ miles from and 90 feet above the city.

For between two and three months in the year the supply is deficient, and it is necessary to pump water into the reservoir by a Hooker pump from two wells of 11-in. bore, and respectively 100 and 120 ft. deep, in the city.

Distribution is by five miles of wrought iron pipe of from 13 to 3 in. diameter, with 7 fire hydrants, 8 gates and 135 taps. The city does not pay for public water. Service pipes are of wrought-iron.

The population in 1880 was 1,621. The daily consumption is not known.

No financial statistics are given. The City Council fixed the water rates so low as to be unremunerative. The works are controlled by E. McLaughlin, of San Jose. James Pettitt is the superintendent.

TO BE CONTINUED.

The receipt of statistics as follows is acknowledged with thanks: From D. C. Sanford, Assistant Engineer, statistics of Wallingford, Conn., Water-works. From James Pettitt, Superintendent and Collector, statistics of Gilroy, Cal., Water-works. From W. H. Duke, Superintendent, statistics of Santa Cruz, Cal., Water Company's works. From Theodore Clift, Secretary, statistics of St. Johns, Newfoundland, Water-works. From J. T. Desmond, C.E., Baton Rouge, La., statistics of Haverhill, Mass., Water-works. From J. P. Boon, Superintendent, statistics and water rates of Salem, Va., Water-works. From D. Goffe Phipps, statistics of Connecticut Industrial School for Girls Water-works. From B. H. Hull, Engineer, statistics of Bridgeport, Conn., Water-works.

CORRECTION. Jan. 20, 1883. *Cochituate Village Reservoir* holds 16,000,000 gals. *Guelph.* For Riper read river. *Fargo,* for quadruplet, read quadruplex. *Topeka.* The superintendent's name is Mood, not Wood. *Wallingford,* Conn. For Pistapang read Pistapaug.

ENGINEERS AND ENGINEERING IN OTHER LANDS.

(Specially translated and prepared for ENGINEERING NEWS).

FOREIGN ENGINEERING ASSOCIATIONS.—Engineers throughout the world are evidently beginning to understand the advantages of solidarity, and clubs are to be met in every country. There are many reasons why there should be a close feeling of brotherhood—the arduous labors; the fact that in every great engineering undertaking, men of various nationalities are to be found together, and that the practical engineers of every land are continually contributing to the common fund of information.

The French Club lately held its annual election, when M. Marché was chosen president. He was formerly professor at Lausanne, and is at present connected with the North Spanish Railroad, and the Madrid Gasworks. He has written some valuable articles on the physical properties of steel, especially as bearing on railroad purposes. The society was founded in 1848 by a few civil engineers, of whom only one now remains.

The foreign societies almost universally admit architects, and certainly there is a certain modicum of what may be termed the "fitness of things" in the proceeding, when, as in Switzerland, the number of engineers is limited. Yet they are not so scarce as to prevent an irregularity in the scale of fees which it is now determined to rectify.

The Italian engineers and architects were to hold their congress in Rome from Jan. 15 to 21. They have determined to carry on the proceedings in sections, viz: architecture and building; road and railroad building; water-works; industrial (mechanical) engineering; sanitary engineering; geodesy, topographical surveying, and agricultural engineering.

The Austrian engineers and architects seem to be able to have weekly meetings for the "feast of reason," and periodical ones for the "flow of soul." An invitation was sent out to pass New Year's Eve in a social (*gemüthlichen*) festival. But even when these gentlemen go to the country they seem to meet with very cordial receptions. On a recent excursion to Brunn, they were received at the railway station by a torchlight procession of professors and students.

The Rio Janiero Engineering Club seems also to have a cosmopolitan membership, although founded only a few years ago. In looking over the list of the engineers employed on the Brazilian railroads, one is struck with the number of English names, and that most of them belong to natives of the "tight little isle," is proved by the addresses appended. Thus the Count d'Eu railroad, now building, has for engineers, Messrs. Johnston, Carling and Latham, the Great Western Railway has its headquarters in Westminster, London, and it has also a fair representation of Englishmen. The Alagoas Railway Company is another Great Winchester and Westminster concern, and the chief engineer has also his offices in Westminster. The line from Bahia to Sao Francisco has for president M. Weguelin, 28 New Broad street, London. The resident engineers and principal employés of the line bear decidedly Anglo-Saxon names. The Brazilian Imperial Central Bahia R.R. is another London enterprise. The president is Mr. Stride, 3 Queen street, Cheapside. The chief civil engineer and the locomotive engineer are probably English. If we take a purely Brazilian line, as the Estrada de Ferro D. Pedro II., we find the converse of this. The long Brazilian names "double up" on the printed page; one of the conductors bears the name of "Henrique Augusto de Sepulveda Everard," and another writes his signature "Antonio Augusto da Costa Lacerda Junior." The Minas and Rio R. R. is an English enterprise. Mr. Raikes, Victoria street, London, is the president; the chief engineer has his office in Victoria street, and the contractors' address is Victoria street, London. The "Estrada de Ferro D. Thereza Christina" has for its president General Beadle, of the Royal Engineers, and the chief engineer, Mr. Neate, M. I. C. E., has an office in Victoria street; and there is quite a constellation of English engineers and superintendents of sections.

Mr. John Beattie, of Moorgate street, London, is president of the line from Porto Alegre to Nova Hamburgo and the chief employés are evidently of English origin. There certainly can be no fault found with English capitalists for thus developing the resources of Brazil, but certainly a great deal of the necessary material for such works would have been purchased here if American contractors and engineers were more represented. At the same time it may well be questioned whether Brazil has not been going too fast in railroad building and other matters—such as running up a great debt—of late years.

THE OHIO SOCIETY OF SURVEYORS AND CIVIL ENGINEERS.

The fourth annual meeting of the County Surveyer's Association, of Ohio, convened at Columbus, O., on the 17th, with President F. J. Sager, of Marysville, in the chair.

In his annual address, President Sager called attention to the fact that the past year was one of great prosperity to surveyors and engineers in this country. More than 12,000 miles of railroad were constructed, which is nearly one-eighth of the entire mileage previously existing. Of this Ohio had its fair proportion. The open winter and wet spring of last year brought out an unparalleled amount of road building and ditching, as the shrewd landowner is not slow to see how rapidly the value of real estate is enhanced by the construction of public improvements in his vicinity. He deplored the fact that the statistics of the improvements in many counties are not detailed enough to show the great amount of such works completed and the benefits derived therefrom. He cited the instance of Union county, which in 1867 had not a rod of graveled pike, and now possesses nearly five hundred miles of such, and not a single tollage; and this improved state of the highways has greatly contributed to more than double the value of real estate in that county. The counties in the northwestern part of the State have made very extensive progress in ditching since the passage of the Ohio drainage laws. A great complaint he thought is the peddling out by the County Commissioners, of these works to incompetent men, whereby much money is wasted, and it is a fact that no engineers are so poorly paid, as a general rule, as those engaged in the county public works of Ohio. For instance, in the surveying and leveling of county ditches, but a dollar and twenty-five cents per day is allowed for the assistant, for which reason unskilled men have to be employed at that low rate, and a consequence is that it takes the surveyor, longer and costs more money in the long run to complete the work. A competition among the surveyors has resulted in some of these evils with which they now have to contend. Their services have been depreciated, their fees cut down below those of other professions because by a law lately enacted, a man who cannot read or write may be selected to serve as County Surveyor, and one object of this Association is the prevention of such proceedings, and to improve the land surveying service of Ohio. It is no longer the question with land owners, "What are your fees," but "Can you measure correctly my land, as I have sold it at $100 an acre." The thanks of the Association are due to General Pond and other members of the Legislature for the attention they have given to the subject of improvement of the land surveying and engineering services in this State.

The reports of the Secretary and Treasurer as to the condition of the Society were very favorable.

At the evening session the new constitution was unanimously adopted. The following gives the name and objects of the Association;

The "Ohio Society of Surveyors and Civil Engineers" (as it will henceforth be called), has for its object the encouragement of professional improvement and of good fellowship, by annual meetings for the presentation and discussion of papers on scientific subjects. Any practical surveyor, civil, or other engineer may be a member, while all interested in engineering improvement or scientific study may be elected, by unanimons vote, honorary members. The officers of the society are to be a President, Vice-President, Secretary, Treasurer and an Executive Committee of five members. Compensation of these officers may be provided for by the society. Voting on applications for membership is to be by ballot, five or more negative votes rejecting a candidate, but no record is to be kept of such rejections. The initiation fee for membership is three dollars. A "fellowship fund," by donation and subscription, is to be established, which, when large enough, shall be used to provide a permanent place for society meetings and the preservation of engineering models and works, that may be donated. Those donating or subscribing to this fund, shall be called "Fellows of the Society." Until the fund is large enough to be used for the above purpose, the interest thereon is to be used for the publication of the annual reports. It is also provided that ten or more of the members may, by vote of two-thirds of the members present at any regular meeting, establish a "Section of the Society" for the advancement of any special branch of engineering.

A code of rules and instructions for country surveyors has been compiled by the committee for that purpose appointed at the last annual meeting, and distributed among the members. It has been sanctioned by the Governor and Secretary of State, Professor McFarland, of the State University, having assisted in the compilation.

In the evening the by-laws under the new constitution were discussed and adopted. Mr. L. E. Gurley, the celebrated instrument maker, of Troy, New York, who brought with him a number of transits, levels, etc., of the most improved patterns, delivered a short address on the use of instruments in surveying, which was declared by the members to have some very useful instructions.

Previous to the opening of the morning session on the 18th the Board of Trade room presented a very animated scene, being crowded by the members comparing transits, levels, and many other surveying instruments, as well as blanks, field notes and draftsman's work. The unanimous opinion was, that if no other features were presented at the annual meeting, this comparison of each other's work and methods would alone compensate them for the trouble in attending the meeting.

At 9:30 President Sager called the meeting to order, and Mr. S. A. Buchanan, of Bellefontaine, read an exhaustive review of public highways. It appears that since the Free Turnpike law of 1863, about four thousand miles of such free highways have been built in Ohio. In some counties the value of public roads amounts to half a million dollars. Shelby county alone possesses roads to the value of $900,000. He showed that England, up to the year 1819, was in as bad a state concerning its roads as this country. About that time McAdam and others began to make the matter of road building a study, legislation from time to time made necessary laws, and as a result England now has good highways. Before that time, any worn-out farmer, servant or other incompetent man was considered the proper person to take charge of the roads; and we are only repeating the experience of England in this country. Mr. Buchanan's idea was that the County Commissioners and Surveyor should be a Board of Road Commissioners; the county to be divided into three sections, and one Commissioner to be personally responsible for and supervise one of these sections. Never should any part of a road or bridge be allowed to be damaged without immediate attention.

The following resolution was offered by Mr. E. D. Shreve, and adopted:

Whereas, The Legislature and courts of Ohio have pronounced most decidedly in the favor of the public reclaimation of wet lands in this State, as is clearly proven by the statutes now in force, and the decision of the courts, based on such statutes, and this subject therefore becomes a matter of prime importance to Civil Engineers, and especially since there are many inconsistencies in the recent laws that need to be improved upon; therefore,

Resolved, That all matters pertaining to the matter of the public reclaimation of wet lands be referred to a committee of five, one of whom shall be the Chairman of this Association; and that said committee be authorized to secure all needed modifications of the laws on this matter.

It was also ordered that the Secretary have the first four annual reports bound in one volume, to be deposited in the Ohio State Library, and a copy to be presented each State officer.

Another resolution on the best system of procuring means to lay out and construct public ditches, was offered by Jonathan Arnett, and referred to the Committee on Ditches.

A communication was received from Secretary of State Newman, asking the Society to consider the code of regulations published for the guidance of County Surveyors, and in case any alterations are deemed advisable to confer with him. A committee of three will be appointed for this purpose.

After the noon recess, discussions took place on the subjects of Assistants' fees, and the merits of the bill to require surveyors to take out a license. A motion to have the place of meeting extended to places other than Columbus, for the examination of applicants, was adopted.

The report of Treasurer Benjamin Thompson was approved, and a vote of thanks extended to

him for the compilation of reports. The annual report of the Executive Committee was also accepted.

By invitation, the Society in a body, at 4 P. M. went to visit the northeast sewer, on East Friend street. The methods of working and the Carson sewer machine were fully explained.

At 8.45 P. M., Professor R. W. McFarland delivered an interesting address on the history of surveying, beginning with the earliest data known. The subjects of land grants of this country, and of the surveys in Ohio, were discussed by the Professor, who remarked that the mastering of the intricacies of the Ohio surveys was a great accomplishment for the professional man. He exhibited a chart demonstrating the different lands in Ohio, and the modes of their being surveyed. The society tendered him thanks for the instructive features of the lecture.

After this, the instruments in the room were critically examined and compared. Most of the members present attended the last two annual exhibitions of such instruments in Cincinnati, and they are all agreed that the present display is much more extensive. Transits, levels, etc., to the value of several thousand dollars, are on exhibition at this meeting.

The morning's session on the 19th was begun at 9:30, when Mr. Gurley gave some desired instruction and advice in regard to the use of instruments.

R. S. Paul, C. E., of Akron, delivered an exhaustive history of the office of County Surveyor in Ohio, which was mainly of a statistical and chronological nature, and which will prove a useful reference when printed.

J. B. Strawn, C. E., of Salem, read a paper on Sanitary Engineering, and Vice-President Jonathan Arnett, of London, reviewed the important part that engineers in all ages since early times have taken in most of the principal improvements in material civilization.

Standing committees were announced and sundry resolutions passed. The membership of the society now is about seventy-three.

All the officers of the past year were unanimously re-elected and are as follows: Fred. J. Sager, President; Jonathan Arnett and F. M. Davidson, Vice-Presidents; W. C. Rowe, Corresponding Secretary, and Benjamin Thompson, Recording Secretary and Treasurer. The Executive Committee was also re-elected. The society adjourned till the second Tuesday in January, 1884.

The meeting was a very enjoyable and profitable one and shows a suggestive and encouraging improvement over previous ones.

CONCERNING BRICKS.

A technical contemporary gives the following facts: An average day's work for a bricklayer is 1,500 bricks on outside and inside walls; on facings and angles and finishing around wood or stone work, not more than half of this number can be laid. To find the number of bricks in a wall, first find the number of square feet of surface, and then multiply by 7 for a 4-in. wall, by 14 for an 8-in. wall, by 21 for a 12-in. wall, and by 28 for a 16-in. wall. For staining bricks red, melt 1 oz. of glue in one gallon of water; add a piece of alum the size of an egg, then one-half pound of Venetian red, and one pound of Spanish brown. Try the color on the bricks before using, and change light or dark with the red or brown, using a yellow mineral for buff. For coloring black, heat asphaltum to a fluid state, and moderately heat true surface bricks and dip them. Or make a hot mixture of linseed oil and asphalte, heat the bricks and dip them. Tar and asphalte are also used for the same purpose. It is important that the bricks be sufficiently hot, and be held in the mixture to absorb the color to the depth of one-sixteenth of an inch.

THE IRON MARKET.

Plate and Tank Iron.—Prices are as follows: 2.5@2.6c. for Tank and Boat Plate, 3.5c. for Shell, 4.25@4.5c. for Flange and 5.5c. for Firebox.

Structural Iron.—Angles, 2.6c.; Tees, 3.3@3.5c.; Beams, 3.5c. and Channels, 3.7c.

Wrought-Iron and Pipe.—The demand is fair and the tendency is toward improvement in prices. Discounts are 55c. on Boiler Tubes, and 65@67½c. on Gas and Steam Pipe.

Manufactured Iron, Chicago, Jan. 22.—Merchant Iron is in fair demand. Bar, 2.40@2.50c.; Angle, 3.50@4c.; T, 4c.; Beams and Channels, 4¼@4¼c.; Hoop, 3.60@4c.; Sheet, Plate and Tank, 3.50@3.80c.; Norway Iron, original bars, 4¾c. rates; Norway Iron, re-rolled, 5¾c. rates; Ulster, 4¼c. rates; Low Moor Iron, 8c. rates; Nuts and Washers, 8c. off list; Wrought Boat Spikes, 3¼c. rates.

THE NEW PULSOMETER.—This company has just received an order from the Philadelphia & Reading Railroad for thirteen of their No. 8 pumps, 5 in. suction, 750 gallons per minute, to be used on their steam colliers for pumping water ballast. They are now working on orders received from South America, Cuba and Mexico, for pumps of various sizes.

THE PANAMA CANAL.—Shipments of *materiel* of all kinds to the canal continue to be made regularly, and there seems to be a great desire to push forward the work. Progress is reported from the different stations, Gorgona, Bas-Obispo, Emperador, Culebra, etc. That the canal presents some problems that have not been yet satisfactorily solved is now, however, evident. Among the principal is the Atlantic opening. The Bay of Limon is exposed to dangerous winds, especially north and northwest, which render the approach very difficult. As many as thirty-five vessels were lost in seven such storms. The deposits of sand would be very great, and it has been, therefore, decided not to have the entrance of the canal in the bay, but in Folks River, as the original plan of Wyse and Reclus would necessitate the building of a very long lateral jetty, while a second mole will be made at Manzanillo point to protect the inside port from the current. There seems to exist some diversity of opinion also with regard to the Pacific entrance—one plan is to have the axis of the canal pass along the left bank of the Boca between the *cerros* Ancon and Sosa, but the entry would lie too much in a straight line and the sea channel would not be sufficiently long. The important point here is the sea bottom, as the sea channel should be at least from four to five kilometres in length. The line which in all probability will be adopted, is one running into the Boca (mouth of the Rio Grande), and which, making a curve, runs along the base of the *cerro* Farfan and then continues in a straight line to the anchorage of the island. The dredge will be used some six or eight kilometres from the mouth.

MEXICAN RAILROAD CONCESSION.—The Government organ publishes a contract signed on the 10th inst. by Sullivan with the Mexican Government by which all the Mexican National Construction companies' concessions are consolidated, and now form one concession on the following basis: The portions of the road finished cannot be forfeited by admitting foreign states as shareholders; the subsidy of $11,270 per mile is payable by 6 per cent. of the gross receipts of all custom houses, instead of 4 per cent., as in the original concession; the payment of 6 per cent. of all duties in the companies' certificates is obligatory on all the merchants. The ports of Matamoras, Mier, New Laredo and Manzanillo are declared open to foreign and coasting vessels. The Matamoras and Monterey lines are to form a part of the Palmer-Sullivan system. All the lines are to be finished in ten years. An increase of tariffs is also agreed on. The Government statistics show that the company had 434 miles of the road completed on December 31st.

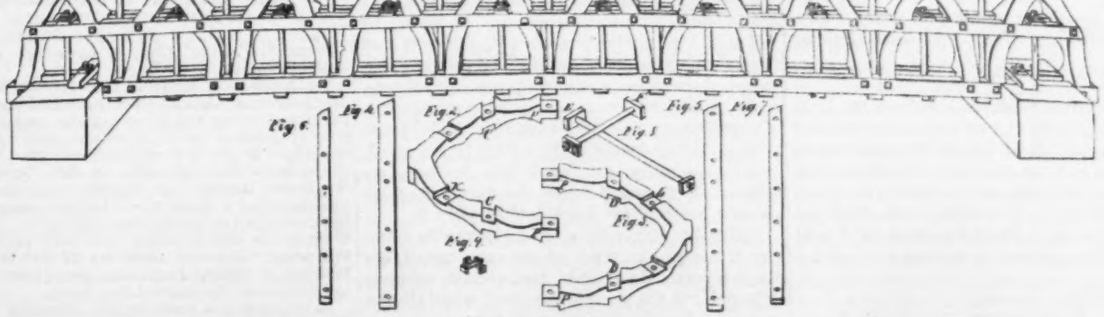
TRUSS BRIDGES.

AN ILLUSTRATED HISTORICAL DESCRIPTION OF ALL EXPIRED PATENTS ON TRUSS BRIDGES, WHICH UNDER THE LAW ARE NOW PUBLIC PROPERTY AND FREE TO BE USED BY ANY ONE.

By F. B. Brock, Patent Attorney, Washington, D. C.

April 11, 1854, George W. Thayer, of Massachusetts, took out letters patent for a bridge truss.

Fig. 1



THAYER'S BRIDGE.

Each two of the Gothic arches (Figs. 2 and 3) are locked together at *K* and *L*. The lower chords are applied to the tenons or shoulder *P*. The upper chords are applied to the shoulders *C* and *D* near the middle of the braces, and are secured thereto by the bolts, shown in Fig. 9. The longer rods (Fig. 8) pass through straining blocks *E* beneath the lower chords, or through straining beams beneath the lower chords and running across the bridges, extending upwards between the chords and through the top of the Gothic arch braces, where they are secured by straining blocks, and nuts and screws.

Thayer claims the advantages for this truss to be that it is not so much affected by extremes of temperature, that there is no thrust strain on the chords, but that the greater the pressure on the truss the nearer the parts are brought together; and, finally, that every piece supporting a part of the whole structure there is no dead weight of iron or useless material.

(TO BE CONTINUED.)

ENGINEERING NEWS
AND
AMERICAN CONTRACT JOURNAL.

Tribune Building. New York City.

The Engineering News Publishing Company, Proprietor.
GEO. H. FROST, Treasurer.

SATURDAY, JANUARY 27, 1883.

EDITORIAL ANNOUNCEMENTS.

Terms of Subscription.—To the United States and Canada, $4 per annum, including postage; all parts of Europe and Mexico, $5, payable in advance. Remittances at the risk of the subscriber, unless made by registered letter or by draft, check or P. O. order, payable to GEO. H. FROST.

Terms of Advertising.—One inch, 12 lines, one insertion, $2; one month, $6.50; three months, $17; six months $30; one year, $50. Special rate for large space and long time will be given on application. Advertisements inserted for less than three months, payable in advance; for longer time, payable quarterly.

Articles for Publication in the current number should be received at the office of publication not later than Thursday morning, and advertisements not later than Friday noon.

Correspondence upon subjects which naturally belong to the province of this journal is solicited.

NOTICE OF MEETINGS.

NEW YORK ACADEMY OF SCIENCES, No. 12 West Thirty-first street, Monday evening, January 29, 1883, at 8 o'clock, in the large hall. The following paper is announced: The Decay of the Building-stones of New York City (with Lantern illustrations from American and Foreign Architecture.

DR. ALEXIS A. JULIEN.
O. P. HUBBARD, Secretary.

Lecture tickets are not required for this meeting.

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TRANSACTIONS OF AM. SOC. C. E.—The November number contains Mr. Wm. P. Shinn's paper "On the Increased Efficiency of Railways for the Transportation of Freight," and Mr. Wm. Bell Dawson's paper on "Rapid Methods in Topographical Surveying."

SANITARY ENGINEERING.—C. Henry Roney, C. E., delivered the second lecture on sanitary engineering at the Franklin Institute, on Tuesday evening, the 16th, the subject being "House Drainage and Ventilation." The third lecture of the course, "City Drainage," was delivered on last Monday evening.

LOCATING CURVE.—The problem from Mr. L. E. Vel which appeared in our first issue this year under the above caption has elicited answers so numerous and in some cases so voluminous both as to drawings and text as to preclude the possibility of publishing all of them. As they are still coming we have decided to wait until next week and then present a summary of all received.

WESTINGHOUSE AIR BRAKE.—The Westinghouse Brake Co., limited, has lately issued a pamphlet describing a series of exact and very interesting experiments which have been conducted at their works, to decide certain disputed points regarding the performance and efficiency of the automatic vacuum brake. The results are given in *Engineering* of the 5th inst. The agents for *Engineering* are John Wiley & Sons, 15 Astor place, N. Y. City.

PI ETA SCIENTIFIC SOCIETY.—The December number consists of three papers, as follows: "The Phœnix Column," by Geo. A. Just, C. E.; "Problem in Railway Location," by Thos. M. Cleemann, C. E.; "Experiments on Pin End Latticed Columns," by Wm. H. Burr, C. E. During 1882 the following other papers have been published: Theory of the Masonry Arch, by Wm. H. Burr, C. E.; Braced Iron Piers, by Thos. M. Cleemann, C. E.; Notes on Railroading, by J. A. L. Waddell, C. E.; The Camber of Bridges, by Thos. M. Cleemann, C. E.; The Inter-Oceanic Canal, by W. E. Dauchy, C. E.; Bridge Pins—Their Sizes and Bearings, by J. A. L. Waddell, C. E.; Rational Fractions, by Adolfo E. Bescsa, C. E.; Note on Gordon's Formula for Long Columns, by W. H. Burr, C. E.; The Size of the Angle Block in a Howe-Truss Bridge, Thos. M. Cleemann, C. E.; Discussion of Paper on "Braced Iron Piers," by Wm. H. Burr, C. E.; A System of Designing Highway Bridges, by J. A. L. Waddell, C. E.; Grades and Curves, by H. G. McClellan, C. E.; Modern Sanitary Engineering, by Richard Prescott, M.E.; Manufacture of Paper, by Geo. H. Ennis; Chicago from an Engineering Point of View, by Chas. J. Bates; The Manufacture and Use of Cast Iron Pipes, by P. H. Baermann.

To obtain these papers address the secretary of the society, at Troy, N. Y. We do not know what the price of the volume is.

REPORT OF TESTS OF METALS FOR INDUSTRIAL AND OTHER PURPOSES, BY COL. T. T. S. LAIDLEY—WATERTOWN ARSENAL—AUG. 31, 1881.

The above report, of which we recently received a copy, is a very valuable addition to our stock of information in regard to the strength of practical forms and details of constructive material.

It contains, besides the special ordnance, tests upon bursting of cast iron cylinders variously prepared to represent gun sections; tests of universal interest to all constructors; tests of wrought iron beams; tests of the transverse, compressive, tensile and shearing resistances of various woods. An extensive series of tests upon wrought iron latticed channel columns mostly with pin ends; tests of bridge pins; tension tests of bar iron and forged eye bars; experiments on friction of iron and steel, both sliding and rolling, &c.

The whole work of 255 pages is full of valuable and most desirable data, and we must congratulate the Ordnance Department in having so usefully employed this testing machine.

We regret, however, to find that, full of meat as the report is for the healthy appetite of students of practical construction, it is also full of errors, partly of typography and largely through neglect in expression and in noting sufficient data.

Were the data of the tests more fully given, the value of the volume would be largely enhanced. In analysing the tests of any series it is very necessary that even small points be noted, as they may give the key to interpret results which often appear contradictory and anomalous. Moreover, by full data, information of an entirely different kind from the purpose of the original test may be determined. As instances of our criticism we would note, under rolling friction, we are given the diameter of the rollers and the total load and the coefficients of friction, but the length of the rollers is not noted. Now, what value can we give a frictional coefficient if we do not know the very important element, *pressure per lineal inch of roller?*

Under the column tests, we are given the diameter of the pins in some of the experiments, but not in others. We are told that certain columns deflected "in the plane of the pins" when all the context shows that the columns deflected perpendicularly to the plane or axis of the pins. Test No. 1,110 is referred to, but is omitted from the volume.

Separators between the channels of the columns are spoken of, but where located and how many there are in a column, and whether they are in all the columns or only in a portion, is not described.

If the manner of holding the pins when testing these columns had been illustrated, and the number of times one pin could be used before it was injured noted, we would have very useful data upon the bending of pins under repeated tests, from which to obtain very desirable conclusions.

We do not make these remarks to detract from the great merit of these tests, but as showing how much more valuable the same tests could be made without any additional expense, and to impress upon the managers of this machine the necessity of placing every student of the tests in a position to properly analyze the results. The Ordnance Office has just issued to the manufacturers of structural material, bridge engineers, architects, railroad companies, &c., a circular accompanied by a programme furnished by the American Society of Civil Engineers, asking for compression members of practical forms and sizes, to complete a series of tests at the Watertown Arsenal. We earnestly urge all in a position to comply with this request to do so, and believe that such co-operation of the manufacturers with the Ordnance Department will enable all designers, constructors and users, to more intelligibly design, construct, and obtain economical results from their material. The amount appropriated for this purpose is but ten thousand dollars. If, by the above co-operation, results can be obtained far in excess of the value of the appropriation, there will be no hesitation hereafter in the appropriation of suitable sums to carry the investigation into other desirable fields.

That all who may desire to furnish any columns for this series of tests, may know what has already been done, we will publish next week the results of the tests contained in the above report upon pin connected columns and an analysis of the same. We give below the circular issued by the Ordnance Department.

ORDNANCE OFFICE, WAR DEPARTMENT,
WASHINGTON, Jan. 19, 1883.

DEAR SIR: The last Army Appropriation Bill, in the item appropriating ten thousand dollars for caring for, preserving, using and operating the U.S. Testing Machine at the "Watertown Arsenal" provided as follows:

"And the Chief of Ordnance shall give attention to such programme of tests as may be submitted by the American Society of Civil Engineers, and the record of such tests shall be furnished said society, to be by them published at their own expense."

In the furtherance of this object the society of Civil Engineers have addressed to me the accompanying letter. I concur fully with the society in the terms of their programme, believing them to be most equitable, in view of the small appropriation now available.

If parts and pieces, free of cost, are placed on board of some transportation line and sent to the Watertown Arsenal, Watertown, Mass., at the lowest rate of freight, &c., &c., furnishing this Office a statement of the composition of the metal and the process of manufacture, &c., this Department will pay the freight, test the pieces, account for scrap, furnish early reports to the sender, and to the Society of Civil Engineers for publication.

Very respectfully,
Your obedient servant, S. V. BENET,
Brig. Gen., Chief of Ordnance.

AMERICAN SOCIETY OF CIVIL ENGINEERS,
127 EAST TWENTY THIRD STREET,
N. Y., Dec. 23, 1882.

General S. V. Benét, Chief of Ordnance U. S. A., Washington, D. C.

DEAR SIR: The Board of Directors of the American Society of Civil Engineers has had under careful consideration the subject of the preparation of a programme of tests of structural materials, to be submitted to you in accordance with the provisions of the last Army Appropriation Bill. In this duty the Board, through its President and Secretary, has consulted a number of persons interested in the investigation, production, and use of structural materials, and including not only members of this society, but also members of the American Institute of Mining Engineers, and of the American Society of Mechanical Engineers.

In response to a letter on the subject a number of replies have been received, an abstract of which has been compiled, and a copy of which abstract is at your service.

Some delay has occurred in communicating with you. This delay has been occasioned by the illness and death of our late President, Mr. Ashbel Welch, who was chairman of the committee having this particular matter in charge, and who was about to call upon and consult with you when prevented by his last illness.

A number of the gentlemen interested in this

subject recently met, and after considering all the suggestions that had been received, brought into practical shape a general programme, which the Vice President of this society informally submitted to you a few days since. In accordance with your suggestion at that time, there is presented to you herewith this programme:

PROGRAMME.

Congress has appropriated the sum of $10,000 for "caring for, preserving, using and operating the United States Testing Machine at the Watertown Arsenal" for the fiscal year ending June 30, 1883.

In order to produce the largest immediate results with the small amount appropriated, we suggest that the investigation be limited this year to the compression members of structures, and that the co-operation be invited from railroad companies, bridge engineers, architects, and manufacturers and users of structural material strained in compression.

For this purpose we suggest that the Ordnance Department of the United States Army should offer to pay the freight on and to test duplicate compression members, either from structures which such parties may have in progress of construction, or special shapes prepared for this purpose, provided the same be furnished free of further cost.

If the parties will cause to be manufactured one or more duplicate compression parts from each bridge or structure which they may undertake hereafter, or will furnish special shapes, varying in proportions, preferably in series from twenty to sixty diameters, and varying by increments of five diameters; or if they will manufacture special shapes which they desire to have tested; if they will also furnish at least three small or hand specimens of the same material, prepared as indicated in the note below;* if they will place these parts and pieces, free of cost, on board of some transportation line, obtaining the lowest available rate of freight to Watertown Arsenal, and notify the Chief of Ordnance of the particulars of shipment, also furnishing, so far as they can, a statement of the composition of the metal and its process of manufacture, and a diagram showing the position the member is intended to hold in the structure, and the computed strain it is expected to bear, that then the Ordnance Department will:

1. Pay the freight on the shipment from the initial point to Watertown Arsenal.
2. Test the compression pieces in due course, as well as the hand specimens.
3. Account to the shipper for the value of the scrap, if required, when the same is sold, or return the same to the shipper, if preferred, paying the freight from Watertown.
4. Furnish the shipper an early special report of results of the tests of all pieces sent by him, giving him an opportunity of sending a second piece to cover any defects that may have occurred.
5. Furnish the American Society of Civil Engineers promptly, for publication and distribution, full copies of all tests and information obtained therefrom.

Respectfully submitted,

W. H. PAINE,
Vice-President Am. Soc. C. E.
JOHN BOGART,
Secretary Am. Soc. C. E.

THE IRON TRADE AND RAILWAY BUILDING IN 1883.

The cause of the present unsatisfactory condition of the American iron trade is twofold. First is the natural declining tendency of prices due to enormous productive capacity and moderating demand. Second, is tariff agitations in Congress. The protectionists for some reason or other have not made as vigorous a fight as they usually do, believing perhaps that the popular demand is for a sweeping reduction of duties and that it is better to submit to such a reduction in the present Congress rather than risk harsher treatment at the hands of the next. The present Congress contains members who will not be in the next, and it is thought that some of these have felt themselves at liberty to act without regard to the interests of their constituents. A majority of the next Congress will be composed of those who do not regard protection as a cardinal principle and who, therefore, cannot be relied upon to act with the protectionists. Notwithstanding this supposition, there are not a few who would prefer to see the whole question go over to the next Congress, believing that they would fare better at its hands than they will at the hands of the present. The reason for this belief is, that the expansion of manufacturing interests in the south and west is creating a feeling in favor of protection, and second, that the new party has seen it demonstrated in politics that the people lean to protection when the issue is squarely presented. Whether this be true or not, the fact remains that many of the members who are coming into power have expressed themselves as ready to co-operate with the Protectionists to expand and strengthen the system should it seem to be the popular demand. They desire popularity and power, and are prepared to take such steps as circumstances and necessities seem to warrant. At present writing there is much uncertainty as to the fruit of the pending legislation. The Senate has precipitated an element of discord which may result in the creation of a Conference Committee, and if this should be done, the prospects of a postponement of the whole question will be increased. The House regards this matter as its own, and views with jealousy the interference of the upper branch of the National Legislature. The manufacturing interests throughout the country felt that they were making as great concessions as circumstances permitted in accepting the suggestions of the Tariff Commission, but when the Senate proposed lower duties it aroused the opposition which has since been exhibited. Both Free Traders and Protectionists claim that even the legislation as it is now perfected, contains many discrepancies and inequalities. But the latter are willing to accept it, with all its faults, rather than that any prolongation of uncertainties should involve the interests in any greater losses. Buyers of iron and steel, especially, are waiting for a decision. Railroad companies and large consumers of iron are waiting for a determination of tariff duties. It is very necessary indeed that manufacturers and consumers should know what Congress proposes to do. Nothing is to be gained by any further delay. It is probable that the debate will develop numerous amendments, and that the discussion of the question will be prolonged until a postponement will be actually necessary.

Last year's railway construction exceeded 10,000 miles, at a cost, in round numbers, of $300,000,000. This year's construction will probably be as large, first, because of the naturally increasing demand for railway communication, and second, because of the decline in material of all kinds, especially steel rails, which have declined 30 per cent, The great West and South are filling up; capital is flowing into those remote regions; population is increasing, and the requirements for rail communication are slowly but surely growing. The returns of railway companies in the Southwest show that the expansion of population in that direction is very great and that construction requirements will probably continue during the current year as they did in the last. Iron and steel and their products are lower at present than they have been for several months, and the tendency in prices is toward a still lower level. But this tendency may suddenly change into an upward one, should the tariff legislation be acceptable to manufacturing interests. Consumers are out of stocks and producers have very little on hand. These two facts indicate that an improving tendency is not far distant. Very little of an advance can take place, because imports would then be probable, and the American iron interests are very desirous of excluding as much of foreign products as possible. The imports for the past year were about 1,200,000 tons of iron and steel of all kinds. On Jan. 1 there were 430 furnaces in blast and 280 out of blast, a decline of 36 furnaces in blast during the year and an increase of 18 out of blast. The decrease in production was in charcoal furnaces chiefly. Steel rails are selling at $40 per ton, but for a month past very little business has been done outside of small orders for current requirements. Bridge iron and structural shapes of all kinds are in very moderate request. Prices are low enough to attract buyers, but there is an indisposition exhibited to place contracts for large requirements at present. Plate and tank iron is low, and consumptive requirements are filled from week to week. The restriction which has taken place in Western nail factories has given an upward tendency to prices. Consumers of ore throughout the West are endeavoring to make better terms for ore supplies during the year. The producers have held the position thus far, but, sooner or later, the offers made to develop competing ore fields, and the efforts made in the Lake Superior ore region to increase its out-put will bring about a desirable and necessary reduction. The iron interests enter the year under very favorable surroundings, and the consumption is likely to steadily increase in view of the declining cost. Large crops, expanding population, increasing wealth—all indicate that the heavy consumptive requirements of the past year will be still further increased, and that, casting aside uncertainty and unknown elements to be encountered, the present year will be the most prosperous of any year in our history.

THE EFFECT OF LOW TEMPERATURES ON IRON AND STEEL.

It is a popular belief among mechanics and others, who handle tools and other articles of iron and steel, that breakages occur more frequently in severe frosty weather than when the thermometer stands above the freezing point. This belief is almost universal among practical men, but there are theorists, who entertain different views on the subject and charge excessive breakage in cold weather to causes other than the weakening effect of frost. Men of science (some of them) hold to the opinion that low temperatures do not affect the strength of metals, and argue that the frequent breaking of articles of iron and steel in winter is due to the solidity of frozen substances with which tools, etc., come in contact. To a certain extent this is true, as, for instance, rails, frogs, wheels and axles and like fixtures break more frequently when the road-bed is frozen solid than at any other time. With no elasticity in the road-bed we should expect rails, frogs, axle and wheels to break more frequently than on unfrozen ballast, but it does not follow that the *materials that break* are not weakened by freezing when the ties are frozen solid. The back woodsman invariably warms his axe in severe weather, before commencing to use it, and although the timber is frozen there is no frost in his axe and it stands the strain of cutting frozen timber. Lumber men break chains, and everything that is subjected to strain in cold weather greatly in excess of the breakages in mild weather; and carpenters have a like experience with their tools, and trappers complain of broken springs, and buggy springs snap when frosty. But the greatest sufferers from failures of tools and machinery in cold weather are the railroads. The tools, track and fixtures, rolling stock, bridges, roofs, etc., that break on account of frost is something serious, and the damages resulting therefrom, require enormous sums to repair, not to mention the lives lost, which cannot be replaced, but cost the companies hundreds of thousands of dollars. It is not difficult to imagine that the reason why trackmen break more cold chisels, punches, drills, hammers, etc., in winter than in summer is that the metal on which they are operating being frosty resists the action of cutting tools, and causes fracture by the excessive firmness or solidity of the fibers due to contraction, but how is it that crow-bars, claw-bars and tools that are *not cutting tools* break more readily in cold than in mild weather? Quarry men experience much trouble from breaking of drills and hammers in cold weather, and the frozen granite cannot be more firm than in summer, so that the chains of the lumbermen, the crowbars of the trackmen, and the tools of the quarrymen, and all tools including cutting, punching or drilling tools *must be injured by frost.*

With tracks frozen solid, rolling stock would

* These three or more small or hand specimens to be of the same material as the compression member furnished; to be rectangular, and to be reduced to one-half of one square inch in area of section; to be of the same thickness as that used in the construction of the member, unless that thickness should exceed one inch, in which case the small specimen is to be reduced to one inch.

It is desired as far as practicable to shape these specimens from pieces of the same section as those composing the member, preserving the surfaces as they come from the rolls, excepting the removal of the outer scale.

The length of these specimens should be two feet.

suffer for the want of elasticity even if there were no frost in wheels or axles, but it is believed that *frost in the articles broken*, contributes largely to the destructive effect of low temperatures. Bridges and roofs frequently fail in cold weather by the contraction of truss-rods and other members, and it would be interesting to know the exact amount of strain on the rods at the instant of breaking. It is expected that all materials that enter into such structures will bear a certain strain per inch, and samples are tested to ascertain their breaking strain, and if these tests are made at temperatures above 32° Fah., it would not give the strength at very low temperatures, which would be a "scrap" of valuable information.

It has been noticed by trackmen and others that iron of inferior quality is injured by the action of frost to a greater extent than what is known as "tough iron." The better qualities of iron, such as is used for nice and heavy forgings of machinery, and worked into horseshoes and horseshoe nails are not weakened by freezing to such a degree as hard, brittle, granular or crystallized metal. Cast-iron is rendered almost worthless for many uses in frosty weather, but in summer time makes a very good substitute for the poorer qualities of wrought iron for some purposes.

Some years ago, or, in fact, in the early days of railroading it was believed that hard iron was preferable for rails, being more durable than soft or fibrous material, and the practice of making hard rails has followed up the introduction of steel. But of late those who have given the matter attention are of the belief that rails of soft metal are the most durable. It appears that rails of hard metal "crumble" under the action of wheels, the particles becoming separated in a granular form causing rapid wear, whereas the fibers of softer metal, being tough, fine grained and firmly united, do not throw off crystals, but scales of microscopic proportions, which render wearing out rails a comparatively slow process. If the foregoing propositions are correct, railmakers can "kill two birds with one stone" by adopting the right process of manufacture. By the proper treatment of sulphur, phosphorus, etc., in the manufacture of iron for rails, and a due attention to the chemical part of manufacture, they can no doubt be produced of soft material that will not only be more durable, but will withstand the action of frost better than hard material. And so with other railway appliances and tools. A little chemical research and experiment in the manufacture of iron and steel may result in the discovery of the extent of injury to these metals by frost, and point out a remedy for the evil. Engineers and others who are interested in the quality of iron and steel, and have the facilities for experiment, may, by a series of properly conducted experiments make a discovery that has "millions in it." At all events the world is in need of "frost proof metals," and if they can be produced, many serious accidents will be prevented, thereby saving life and property. Will some of the engineering associations investigate?

THE NEW YORK AND NEW JERSEY TUNNEL RAILROAD COMPANY.

Some time ago this company was incorporated with a capital of $5,000,000. Of this amount $25,000 has been subscribed and is now being used for preliminary surveys, plans, etc. Among the incorporators are the following prominent business men: Wm. T. Hatch, Louis L. Lorillard, Eugene Schieffelin, O. P. C. Billings, H. C. Stetson, H. C. Nichol; S. D. Schuyler, Gouverneur Tillotson, Robt. Jones, John McCracken, H. Clark, and John B. West. The president of the company is W. T. Hatch; vice-president, S. D. Schuyler; chief engineer, John Schuyler; consulting engineer, William E. Worthen. The present office of the company is at 30 Vesey street. The tunnel will start from some point in the vicinity of the City Hall, pass under the Hudson River and connect with the lines of railroad on the other side. On this side connection will be made with the proposed tunnel of the Central Tunnel Company, which starts near the City Hall, extends up Elm street to Lafayette place, Astor place and Fourth avenue and will connect with the Harlem Railroad at Fifty-fifth street. This latter company has finished its preliminary engineering work and has applied to the Supreme Court for the appointment of a commission to designate the route and perform the necessary preliminaries before the work can be commenced.

The object of the scheme is to facilitate the transportation of freight across the Hudson and to avoid the delays now incident and unavoidable by the use of boats. Freight from the Eastern States destined to points on the roads centering on the west side of the river could be moved without the present delays and costly handling, and freight from those roads for this city or the East would receive the same advantages.

The plan for accomplishing this undertaking has not yet been adopted, although several have been proposed and are now being considered by the engineers. One plan is to sink iron cylinders in sections, divers clearing the joints and securing each section to the one previously laid. A bulkhead sufficiently strong to hold the water back would be constructed in the centre of each section. Brick masonry would be built in the interior as fast as the sections were laid and the joints secured. Another plan is to build caissons. Two of these would be made, each one being very long, and wide enough to enclose both tunnels. Air locks for material and men would be placed in the roof. These would be sunk until the shoes rested about half way down the sides of the tunnel, the buoyancy being overcome by weights placed on top. Excavation would be made in the interior and the masonry put in. While this was being carried on in one caisson the other would be placed in front and lowered. Arrangements for moving, sinking and anchoring are provided for, but we are not at liberty to give them.

The plan of using compressed air, as in the tunnel now being built, has not been proposed and will not be considered.

PERSONAL.

Dr. EDWARD H. KNIGHT, the author of "Knight's American Mechanical Dictionary," and other literary works, died last Monday night at his home in Bellefontaine, O.

RICARDO OROZCO, chief engineer of the Mexican Southern Railroad, is in Washington. He is there to consider the practicability of raising funds in the United States to drain the city of Mexico. Twelve millions of dollars are required. Two companies have been formed to do this work.

EMIL DAVID, an old civil engineer, shot and killed himself in Pittsburgh, Jan. 22. It is supposed that he was despondent on account of his failure to procure employment. He was at one time chief of the survey of the Low Grade Division of the Allegheny Valley road, and was for a long time with the contracting firm of Patterson & Co., of Pittsburgh. He leaves a wife and seven children, who live in Brookville, Pa.

CHAS. WARD RAYMOND, Mem. Am. Soc. C. E., sailed in the *Germanic* on the 20th, for England. Mr. RAYMOND was recently Assistant Engineer on the Hudson River Tunnel, but since the stoppage of active work on that unfortunate enterprise, has given his attention to electrical engineering, and now has gone to London on business connected with that subject. His address for the next three months is 41 Cornhill, London E. C.

MR. SOLOMON DRULLARD, an old and well-known citizen of Buffalo, N. Y., died at his residence in that city January 17, aged 75 years. Mr. Drullard was born near London, Ont. He went to Buffalo when about 20 years old and has lived there ever since. For a number of years he was a member of the transportation firm of Kimberly, Pease & Co. Subsequently he was appointed General Freight Agent of the New York Central, and later of the New York Central & Hudson River railroads. This position he held for 20 years, during the latter part of which he was also a director of the company. After leaving the service of the road he became a member of the firm of Drullard & Hayes, with which he has been connected since.

ELECTIONS AND APPOINTMENTS.

CHAMPLAIN TRANSPORTATION CO.—George Rushlow was elected Chief Engineer at last meeting.

ST. LOUIS ELEVATED & RAPID TRANSIT CO.—The directors of this new company are: George W. Allen, W. D. Griswold, R. C. Kerens, John G. Priest, O. D. Tucker, St. Louis; A. Bonzano, Phoenixville, Pa.; F. A. Marquand, Robert I. Sloan, A. W. Soper, New York.

WOODSTOCK R.R.—The following officers have been elected for the ensuing year: President, Frederick Billings; Clerk, Charles M. Marsh; Treasurer and Superintendent, James G. Porter; Manager, S. S. Thompson; Engineer, Hosea Doton. Offices in Woodstock, Vermont.

E. A. HANDY has been appointed chief engineer of the Northern Division of the Mexican National Railway, vice S. T. Fuller, resigned.

AUGUSTA, GA.—A. H. DAVIDSON, C. E., has filled so acceptably the offices of Chief Engineer of Augusta, Ga., and of its Water-Works, that he has been re-elected for four years, the term heretofore being for one year only.

MR. ALFRED WILLSON, who for many years has been Chief Engineer for the Canada Land Company, a position of great responsibility and labor, has been promoted to the office of Chief Clerk, with headquarters in Toronto, Can.

WM. R. MORLEY,

LATE CHIEF ENGINEER OF THE MEXICAN CENTRAL RAILROAD.

We collate from the Las Vegas *Daily Gazette* the following: WILLIAM R. MORLEY was born in Massachusetts in September 1846, but from early childhood he lived in Fayette County, Iowa. He was a boy of strong constitution, restless energy and activity, and the possession of these qualities led him to enlist in the Union army before he had reached the proper age to be a soldier, and as such he was with Sherman's army on its march to the sea. After the war he was a student for a while at the State University of Iowa, but in 1868 commenced his career as an engineer on the Iowa, Northern and Central railroad. In 1869 he accepted a position as chainman on the Kansas Pacific Railroad, but in six weeks time he was in charge of a division. It was here that he established a reputation for cool courage in meeting emergencies, as he continued at his work amid the dangers of an Indian outbreak that seriously interfered with the construction of the railroad. His work on the Kansas Pacific completed, he opened an office as Civil Engineer in Denver, but was soon employed to make the surveys of the Maxwell Grant in New Mexico. In 1872 he was appointed General Manager, as well as Chief Engineer of the Maxwell Company and in 1874 made an unsuccessful trip to Europe to aid in reconciling the conflicting interests of the grant. In 1876 Mr. Morley accepted service as engineer on the Denver & Rio Grande Railway then building across the mountain from Cucharas to Alamosa.

During his five years residence in New Mexico he has made himself very familiar with the whole southwestern region, and had accumulated a fund of practical and accurate information as to its topography, resources and adaptability to the construction and operation of railroads, such as was possessed by no other man. This fact was early perceived by sagacious railroad managers, and when, in 1878, the Atchison, Topeka & Santa Fé Railroad Company commenced its extraordinary campaign of construction into the heart of this great region, they were prompt to avail themselves of Morley's well-known abilities; and from that time forward he was prominently identified with every important work of engineering and construction undertaken by that great corporation and its allies in Mexico. A contest early developed between his company and the Denver & Rio Grande system, for the control of the gateways into these new districts, and one of Morley's first achievements was a night march by which he occupied the line over the Raton Pass, in the face of a large opposition force, specially organized to do the same thing. Far more celebrated, however, was his famous night ride from Pueblo to Cañon City—a contest between horseflesh and steam engines—in which Morley won by half an hour, capturing and holding the Royal George in the Grand Cañon of the Arkansas, which he occupied for some months

thereafter with a large armed force in daily expectation of battle, while twelve miles of one of the most extraordinary pieces of railroad in America were built. He made the preliminary surveys for all the important lines projected by the Santa Fé Company, and Morley's reports of these reconnoisances soon came to have an exceptional value in the eyes of railroad officials on account of the masterly ability they displayed, and the great reliance which it was found could be placed in them.

In 1880 Mr. Morley was appointed chief engineer of the Sonora Railroad, to be built from Guaymas, on the Pacific coast, through Sonora to Benson, A. T. This was a herculean undertaking in a new country, among a strange people, and in a climate of great and exhausting heat. In two years Mr. Morley, with his great energy and resources, triumphantly completed the road to a connection with the Santa Fé road on the Mexican boundary, the last rail being laid Sept. 25, 1882, and the last spike marking the completion of another great transcontinental railway line being driven—with what emotions of pride may well be judged—by Mr. Morley's wife.

Upon the completion of the Sonora road, Mr. Morley was tendered the position of chief engineer of the Mexican Central Railroad, a gigantic enterprise, designed to connect the Atchison, Topeka & Santa Fe system of roads with the City of Mexico. Finding in this undertaking a field for his peculiar abilities even broader and more inviting than he had before encountered, he accepted the position and established his headquarters at Chihuahua.

HOW HE CAME TO HIS DEATH.

Mr. Morley had been on a reconnoitering trip to Zacatecas, 530 miles below, and on returning had gotten to within 90 miles of Chihuahua, when the sorrowful accident occurred. There were four wagons in the train and the one in which Mr. Morley rode was in the rear. The gun, a Winchester rifle, was resting against the front of the vehicle, between the two men on the front seat, with the muzzle inclined upward. It was supposed to be unloaded, as it had failed to explode about an hour previous. Mr. Morley and Mr. D. B. Robinson, General Manager of the Mexican Central Railway, were occupying the rear seat of the carriage, Mr. Morley on the left. Mr. Stewart and the driver were on the front seat. An overcoat, belonging to Mr. Morley, which was lying across the seat between Stewart and the driver, had slipped down under their feet, and at the request of the driver Mr. Stewart was pulling the coat back to its place, when the gun exploded. Mr. Morley at that moment happened to be leaning to the right against Mr. Robinson, and received the bullet in the heart, cutting the aorta. When he first received the bullet he said, "Boys, I am a dead man;" this was spoken in a strong but very low voice. He then arose to his feet and almost without assistance climbed down from the carriage. On reaching the ground he walked forward almost to the heads of the mules and fell, or rather laid down upon the ground. As soon as his companions could reach him, he remarked, "I am sorry that this has happened," and in this manner died without a single struggle.

Mr. Morley was a man in whom individuality was marked to an extraordinary degree. It left its impression on the mind of every one who met him in whatever relation. No man who talked with him for five minutes failed to remember him ever afterwards. His intellectual activity was marvelous. His mind seemed never at rest, and he was never content with the knowledge or information he possessed, but every sense was perpetually alert to discover some new fact or work out some fresh problem. What he did learn was his for all time, for he forgot nothing. Original in his methods and in his conceptions, he was no respector of rules until he had proved them in his own way. He was possessed of an iron constitution and herculean frame, and to them he showed no mercy. The word "fail" was not in his vocabulary, and when he set out to accomplish a given undertaking he spared neither horses nor men, and least of all himself. In its pursuit he was disheartened by no repulse, discouraged by no obstacle, appalled by no danger; but amid circumstances the most trying, and difficulties the most formidable, the sanguine temperament and high courage of Morley might ever be seen, conspicuous above all manner of adversity, infecting the spirits of those around him with the magical influence, making the despondent hopeful and the timid brave, until the end was reached at last. Thus it was that the name of Morley came to be synonymous with success. He asked no man to go where he was not willing to lead, and such was his personal magnetism and such the affection and confidence he inspired by his unfailing care and thought for them that he came to be regarded by his immediate employes with a sort of idolatry. With them his wish was law, and his opinion absolutely beyond question, and all that flesh and blood could do they would do for him if asked. With all this perseverance, energy and daring, his brilliancy in conception and promptness in execution; his fertility of resource and confidence in the success of his undertakings; his value to those in whose service he labored, was beyond estimate. And never did employer receive more faithful service than from him. No man ever trusted him in vain.

TRACK LAID IN 1882—DETAILED STATEMENT.

The intention is to confine our figures strictly to the following limits:

(1). Main line only, not including sidings or additional track.

(2). Main line track actually laid to Dec. 31, not anticipating any work after the end of the year.

(3). Main line track actually laid since Jan. 1, and not including any laid in the previous year.

New England States.

MAINE.

	Miles.
Bangor & Katahdin Iron Works—Completed to Katahdin Iron Works (19 miles from Milo)	13.00
Bridgton & Saco (2 ft. gauge) Hiram Junction n	12.50
Rumford Falls & Buckfield, Canton to Gilbertville	1.50
Total	27.00

NEW HAMPSHIRE.

Pemigewasset Valley — Plymouth n. to Woodstock	17.34

VERMONT.

Montreal, Portland & Boston — Canada Line to East Franklin	1.50

MASSACHUSETTS.

Eastern Junction, Broad Sound Pier & Point Shirley—Point of Pines, s. e. to Ocean Spray	2.50
Old Colony—Whittenton Mills to N. Poynham	2.50
Total	5.00

RHODE ISLAND.

No new construction reported	0.00

CONNECTICUT.

Danbury & Norwalk, South Norwalk to Wilson's Point	2.65
Total New England States	53.49

Middle States.

NEW YORK.

Addison & Northern Pennsylvania (N. G.) Addison s. to Pennsylvania line	10.00
Allegheny Central (N. G.)—Extended from Friendship n. to Swain's (total length 61)	30.00
Bradford, Eldred & Cuba (N. G.)—Little Genessee to Cuba	19.44
Boston, Hoosac Tunnel & Western—Mechanicsville to Saratoga Springs	16.00
Buffalo, Pittsburgh & Western—Brocton e. to Buffalo	50.00
Buffalo, Pittsburgh & Western—Pennsylvania Line n. to Salamanca	15.00
	65.00
Catskill Mountains (N. G.)—Catskill Landing w. to Lawrenceville	14.00
Delaware & Hudson Canal R. R.—Br. Glenn's Falls to Caldwell	9.00
Genessee Valley Canal R. R.—Completed Rochester to Hinsdale 100, by laying in 1882	72.50
Herkimer, Newport & Poland (N. G.)—Newport to Poland	4.00
New York, Chicago & St. Louis—Laid in New York in 1882	49.00
New York, Lackawanna & Western—Binghamton to Buffalo	204.00
New York, Lake Erie & Western—Branch . True's siding to Lakeville	1.50
New York, Ontario & Western—Middletown e. to Cornwall	25.00
New York, West Shore & Buffalo—Various points between Cornwall and Syracuse	146.00
Rochester & Pittsburgh—Salamanca Junction to Pennsylvania line	15.58
Buffalo Br.—Ashford n. 6, Buffalo s. 12	18.00
Silver Lake Br.—Junction to Gainsville	1.33
	34.91
Rochester, New York & Pennsylvania—Genessee Valley Canal R.R. to Swain's.	9.00
Saratoga, Mt. McGregor & Lake George (N. G.)—Saratoga n. to Mt. McGregor	10.50
Stony Clove & Catskill Mountain (N. G.)—Edgewood to Hunter	6.50
Tonawanda Valley & Cuba (N. G.)—Cuba n. to Arcade	33 00
Total	759.35

NEW JERSEY.

Belvidere Iron Company—Buttsville, on Lehigh & Hudson R.R., to Belvidere Iron Co's. Queen Mine		2.25
Central of New Jersey—High Bridge Br.—Port Oram n. to Lake Hopatcong		5.00
Lehigh & Hudson River—Completed between Andover and Belvidere by laying	14	
Branch to Patterson	1	
		15 00
New York, Susquehanna & Western—Completed between Two Bridges and Pennsylvania line		33 00
West Jersey—Branch to Sea Isle City	5.75	
Swedesboro & Woodstown R.R.—Swedesboro to near Oakland	11.00	
Salem R. R.—Extended to Salem.	0.60	
		17.35
Total		72.60

PENNSYLVANIA.

Addison & Northern Pennsylvania (N. G.)—New York Line, 10 miles from Addison, s. w. to Gaines		31.00
Arnot & Pine Creek—Tioga R. R. Co. lessees—Arnot s. w. to Morris		12.00
Bangor & Portland—Pen Argyle to Nazareth		10.00
Baltimore & Ohio—Pittsburgh Div.—Branch to Morrell coke district, near Connollsville		3.00
Buffalo, Pittsburgh & Western, Salamanca Extension—Warren to New York line		16.00
Corning, Cowanesque & Antrim; Cowanesque Valley Br.—Elkland to Knoxville		7.00
Coudersport & Port Allegheny (N. G.)—Port Allegheny to Coudersport		16.00
Eldred & Rew City (N. G.)—Eldred southeast		12.00
Jersey Shore, Pine Creek & Buffalo, Stocksdale Junction s. 18; Williamsport n. 22		40.00
New York, Chicago & St. Louis—N. Y. state line to Ohio state line		44.29
New York, Susquehanna & Western—New Jersey line to Gravel Place		10.00
New York, Lake Erie & Western Coal & R. R. Co.—Alton Junction s. to Johnsonburgh		29.92
Pennsylvania R. R.—Pitts, Va. & Charleston—Uniontown to Monongahela City	18.00	
Pennsylvania R. R.—L. & T. R. R. Juniata Branch to Juniata	2.00	
Pennsylvania R. R.—Tyrone Div. Branch to Sugar Camp mine	3.75	
Pennsylvania R. R.—S. W. Pa. R. R.—Sewickley Br. Youngstown up Sewickley Creek	7.00	
Pennsylvania R. R.—Boyer's Run Branch	1.25	
Pennsylvania R. R.—Bunker's Run Branch	1.40	
Pennsylvania R. R.—Vance's Mill Branch—Red Stone ,Br. to Vance's Mill	2.50	
Pennsylvania R. R.—North & West Br.—Catawissa to Wilkesbarre	43.10	
		79.00
Pittsburgh, Bradford & Buffalo (N. G.)—Tylersburg to Kane		40.00
Pittsburgh, Chartiers & Youghiogheny—Chartiers Junction to Junction No. 1, 7, 4; Junction No. 2 to Essen, 1, 2		8.66
Pittsburgh & Western (N. G.)—Duck Run Junction to New Castle	16.00	
Pittsburgh & Western—Parker to Foxburg	4.00	
Pittsburgh & Western—Butler to Callery Junction	14.00	
		34.00
Philadelphia & Reading—Catawissa & Williamsport Br.—in Williamsport		3.00
Rochester & Pittsburgh—N. Y. line s. to Custar city, N. Y., L. E. & W. R. R.	8.85	
Johnsonburg south	15.00	
		23.85
Shenango & Allegheny, Shenango to Greenville, 2; Coalville Br., 3; South Br., 5; Bull Valley Br., 3; Butler Br., Coalville Junction, s. 2		15.00
Sharpeville (operated by Buffalo Pittsburgh & Western)—Carbon s. to Wilmington, Junction with Oil City & Chicago R. R.		7.00
Warren & Farnsworth Valley (N. G.)—Clarendon (Phil. & E. R. R.) to Garfield.		10.25
Total		461.97

PHILADELPHIA WATER-WORKS.

ITEMS OF EXPENSE EXCLUDING INTEREST ON PLANT TO DISTRIBUTE A MILLION GALLONS PUMPED 100 FT. HIGH BY STEAM POWER ON THE BASIS OF TOTAL MAINTENANCE.

CHIEF ENGINEER.	Year.	Work done by steam pumpage, gallons raised 100 ft. high.	Expense of pumping by steam power.	Items of expense common to steam and water pumpage.							Items of expense where steam pumpage differs from water pumpage.					Expense per million 100 ft. high by steam power.	Average price of coal.
				Engineering.	Registering.	Repairs to Pipes.	Repairs to Buildings, Grounds and Reservoirs.	Incidentals.	Deficiencies.	Expense per million 100 ft. high, common to steam and water.	Pumpage salaries.	Coal.	Lubricants, small stores and gas.	Repairs to machinery.	Expenses per million 100 ft. high, common to steam only.		
Fre'd Graff	1855	2,606,108,681	$83,037.78	.55	1.60	1.62	2.61	1.07	2.22	9.67	5.12	12.96	.79	3.33	22.20	31.87	
Sam'l Ogden	1856	3,509,123,551	65,432.41														
	1857	4,110,677,625	77,126.28														.10
	Total	7,619,801,176	142,558.69	.39	1.25	2.20	1.81	.49	.66	6.80	2.90	5.71	1.10	2.20	11.91	18.71	
H. P. M. Birkinbine	1858	4,813,277,699	80,073.53														4.10
	1859	4,877,172,459	73,012.24														No record.
	1860	4,983,453,449	66,171.34														3.49
	1861	5,072,440,659	68,011.22														3.72
	Total	19,746,343,257	287,868.33	.42	1.55	1.11	1.15	.28	.59	5.10	2.93	5.01	.52	1.02	9.48	14.58	
Isaac Cassin	1862	5,725,822,236	83,549.40														4.61
	1863	5,305,611,876	92,795.45														5.53
	Total	11,031,434,112	176,344.85	.40	1.34	.85	2.66	.28	.13	5.66	2.06	5.70	.45	1.51	10.32	15.98	
H. P. M. Birkinbine	1864	4,597,556,437	123,142.94														9.19
	1865	5,416,764,497	129,407.19														8.83
	1866	4,339,814,549	101,698.15														5.90
	Total	14,354,135,483	354 248.28	.44	1.56	1.47	2.39	.37	.35	6.58	4.08	10.50	.66	2.86	18.10	24.68	
Fre'd Graff	1867	4,305,376,437	86,494.58														5.50
	1868	5,705,710,869	104,453.28														No record.
	1869	7,115,454,638	143,842.71														do.
	1870	7,488,634,027	146,841.11														5.92
	1871	7,554,381,177	141,861.13														No record.
	1872	9,654,031,308	148,512.41														do.
	Total	41,824,188,516	772,005.20	.44	1.30	1.72	2.00	.37		5.83	4.05	6.33	.55	1.70	12.63	18.46	
W. H. McFadden	1873	10,187,323,844	155,396.58														4.78
	1874	12,988,925,707	238,016.57														4.73
	1875	13,871,245,276	311,063.00														5.90
	1870	16,861,280,555	311,206.80														3.98
	1877	15,590,148,734	215,513.48														3.12
	1878	19,782,425,318	227,058.35														3.33
	1879	22,509 472,321	221,404.91														3.12
	1880	23,798,379,018	242,530.20														4.14
	1881	26,663,201,422	314,886 66														4.42
	1882	28,495,833,723	349,073.96														4.48
	Total	190,728,335,918	$2,586,810.51	.66*	1.04	1.29	1.99*	.44*		5.42	2.40	3.92	.39	1.43	8.14	13.56	

* In years previous to 1874, engineering, buildings, grounds and reservoirs and some pumpage salaries were paid from loans and other item. These are on the basis of total maintenance not including loans and other items.

Previous to 1874, the officers of the Engineering Corps paid from salary roll cost $6,000, while those paid on per diem roll from loans and other items cost $21,000. These added make $27,000, and show that the Engineering Corps cost more previous to 1874 than since, though this item appears less on the table previous to 1874 than since. The reason of this is that since 1874 loans and other items have not been used for maintenance.

MARYLAND.

Maryland Central—Formerly Baltimore & Delta (N. G.)—Baltimore N. E. to Little Gunpowder River	19.25
Southern Maryland—Charlotte Hall to Mechanicsville	2.50
Total	21.75

DELAWARE.

No construction reported	
Total in Middle states	1,315.57

—*Railway Age.*

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.

The annual meeting of the above Society was held at Pittsburgh on the 16th. President Gottlieb occupied the chair. Secretary Harlow's report showed an increase of membership of 41, making 262 in all. He stated that it is the largest local society in the country, and has a better average attendance than any other. The reports of the Treasurer and Librarian showed the finances and library of the Society to be in good condition.

The following papers were read during the year: Feb. 21, "The Absorption of Metallic Oxides by Plants," by Prof. F. C. Phillips; March 21, "The Slide Rule," by Edwin Thracker; April 18, "Combination Bridges," by C. L. Strobel; May 23, "Pittsburgh Sewerage," by A. Dempster; Sept. 19, "Furnaces and Combustion," by Ign. Hahn; Oct. 17, "Petroleum," by Max Livingstone; Nov. 21, "Actual Strength of Bridges," by Fred Melber; Dec. 19, "Inspection of Bridges," by W. S. Thompson.

President Gottlieb read his annual address. After referring to the organization of the society and its progress, he went on to say that no city had a more direct interest in the existence, development and growth of such a society than had the "smoky city," with its vast manufacturing interests, employing, as it does, engineering talent in all its various branches. He mentioned that all the engineering papers read before the society had been provided in book form, and each member furnished with a copy. Most of the papers contained in this volume were of considerable value, not only to the members of this society, but to the profession generally. He advised the broad discussion of all papers read, for in some cases the discussions were more important and instructive than the papers which suggested them; such discussions bring out the views and experience of the members, and serves to bring the members together socially. Mr. Gottlieb stated that engineers, as a class, were deliberate, studious, hard workers, but generally not successful as orators, and suggested that these frequent meetings in a hall of their own, for the discussion of professional topics, would have a tendency to make them less shy and awkward, when occasion demanded their appearance on any other stage.

He made an appeal to the manufacturers and railroad corporations in the city and vicinity, asking their aid in establishing permanent quarters for the society, where they could meet every evening if they chose, and have the use of an engineering library. These very corporations had millions invested directly under the care of the majority of the members of this society, and should take a personal interest in its welfare. A moderate sum would answer the purpose, and they themselves would in the end gain by the increased knowledge and efficiency of the engineers in their employ.

Mr. Gottlieb closed his address by expressing his thanks to the officers and directors for their aid during the year, and their interest in the society.

The election of officers resulted as follows: President, A. Gottleib, 1884; Vice-President, F. C. Phillips, 1885; Directors, Max Livingston, 1885, John L. Awl, 1885, Wm. Miller, 1884; Treasurer, A. E. Frost, 1884; Secretary, J. H. Harlow, 1884.

OHIO INSTITUTE OF MINING ENGINEERS.

The third annual meeting of the above society was held at Columbus, O., on the 17th and 18th inst. President Andrew Roy was in the chair. The minutes of the meeting were taken by the Secretary, R. S. Paul, of Akron. Twenty-five new members were added to the list. The society has its own "organ," the *Morning Journal*, the first number of which was published in November last.

Papers on coal mining at Steubenville; horse backs in the lower coal measures and their origin; iron industries of Columbiana County, and the mineral resources of Jackson County were read, their details being of an interesting nature.

The Institute then elected officers for the ensuing year, with the following result: President, Hon. Andrew Roy; Vice-president, Fred Howells; Secretary, R. S. Paul; Treasurer, R. S. Jennings.

The next meeting will be held at Youngstown, O., May 9.

ROAD FROM PEORIA TO SIOUX CITY, IA.—Articles have been filed in Illinois. Capital $13,700,000. Among the incorporators are D. M. Kelly, of Green Bay, and Henry Ketcham, of New London, Wis.

NEWS OF THE WEEK.

GEORGIA & OHIO R. R. (N. G.)—This proposed narrow gauge road is to run from Portsmouth, O., to Atlanta, Ga., via Knoxville, Tenn. The following is the route: South from the Ohio River through eastern Kentucky to Cumberland Gap, thence to Knoxville and south from Knoxville, crossing the Little Tennessee River at or near the mouth of the Tellico River, passing Ducktown and connect at the Georgia State line with the Marietta & North Georgia, now under construction from Marietta northward. The distance is 388 miles.

IMPROVEMENT OF THE WESER.—The works for deepening the Weser from Bremerhaven to Bremen have been begun, and as there are 50 miles of river, the work may be considered as one of the most important at present under way in Europe. It will also contribute to develop the maritime trade between this country and Germany, as the ocean steamers will thus be enabled to go direct to Bremen and not be obliged to break freight as at present. The work will cost 30,000,000 marks and require six years for its completion.

THE ILLINOIS NORTHERN R. R. CHARTERED.—Articles of incorporation have been filed at Springfield, Ill., by the Illinois Northern Railroad Company, which is to be built from Peoria northward to Milwaukee, Wis. Capital stock fixed at $10,000,000.

ELECTRIC LIGHT FOR LOS ANGELES, CAL.—The city council have voted to accept the electric light. The seven masts will cost $1,000 each per annum. The erection of six more masts is being considered. The clerk has been instructed to notify the gas company to shut off all gas lights on the streets.

COST OF LABOR IN PARIS.—The following rate of wages per day are selected from the tariff of the Paris Municipality, as published by the *Imprimerie Nationale:* Brick and tile makers, 4fr. 95c. = 3s. 11½d.; carpenters, 8fr. = 6s. 5d.; cartwrights, 5fr. 50c. = 4s. 5d.; cabinet makers, 6fr. 50c. = 5s. 2½d.; blacksmiths, 8fr. = 6s. 5d.; masons, 7fr. 50c. = 6s.; sculptor masons, 8fr. = 6s. 5d.; joiners, 6fr. 50c. = 5s. 2½d.; house painters, 7fr. 50c. = 6s.; plumbers, 6fr. 50c. = 5s. 2½d.; sawyers, 6 fr. = 4s. 9½d.; locksmiths, 6fr. = 4s. 9½d.; tin plate workers, 10fr. = 8s.; glaziers, 5fr. 65c. = 4s. 6d.; coopers, 6fr. = 4s. 9½d.; wood turners, 5fr. 10c. = 4s. 1d.; metal turners, 7fr. = 5s. 7d.; night men, 7fr. = 5s. 7d.; navvies, 4fr. 50c. = 3s. 7d.

SUBMARINE TUNNEL UNDER THE STRAITS OF MESSINA.—The correspondent at Rome of a German paper writes that the project of a tunnel under the sea between Calabria and Sicily is making rapid progress. The Venetian Railway Company has finished its surveys, and the plans have been submitted to the Minister. The length of the tunnel is 13½ kilometers (8¼ miles), and the cost is estimated at 71,000,000 lire (£2,840,000), including the 5,500,000 lire (£220,000) for the junction between the tunnel and the Messina station.

WATER METER STATISTICS.

The National Meter Company, 51 Chambers street, N. Y., have sent to Water Meter Superintendents, the following card:

January 15, 1883.

Number of meters in use.....
Do you recommend meters for general use?.....
" " " " large consumers?.....
Daily consumption in gallons.....
" average consumption through meter.....
Annual cost of repairs on meters.....
" revenue from meters.....
Number of taps in use.....
Percentage of taps metered.....
Percentage of daily consumption in gals. by meter.....
Daily consumption in gallons per capita.....
Meter furnished by consumer or department.....
Address.....
Please send copy of your tariff of rates to date.

BRINKLY & HELENA R. R.—Articles of incorporation were filed in Arkansas on the 24th inst. The proposed road is forty-five miles in length and will run through the counties of Monroe, Lee and Phillips. The capital stock is $450,000. The Directors will be Wm. Black, Louis Salinger, John Gunn, of Brinkley; R. W. Martin, of Little Rock, and J. T. Henderson, of Newport.

PRICE OF GAS REDUCED.—Reading, Pa., has reduced the price of gas to $2.20.

BIDS FOR NEW COURT HOUSE.—Charlotte, Mich., received proposals on the 24th for building a new court house.

HARRISBURG & WESTERN R. R. INCORPORATED.—A charter was issued on the 25th to the Harrisburg & Western Railroad Company, which intends to construct a line from Harrisburg, Pa., to a connection with the Pittsburg, McKeesport and Youghlogheny Railroad opposite Sewickly Creek, Allegheny County. The capital of the company is placed at $18,000,000, divided into 365,000 shares nearly all of which are held by the Richard K. Shelden, of Philadelphia, the President of the company. The directors are William M. Sanger, Harrisburg; G. M. Watson, George O. Morgan, and George P. Grover, Allegheny City; P. L. McNamara, Pittsburg and Frederick J. Grotevent, Harrisburg. The road will be 300 miles long and will pass through or into the counties of Dauphin, Cumberland, Frankland, Huntington, Fulton, Bedford, Somerset, Westmoreland, Fayette, Allegheny and Washington.

RECORD OF NEW RAILROAD CONSTRUCTION.—This number of the *Railroad Gazette* contains information of the laying of track on new railroads as follows: *Ohio Central.*—Extended from Pt. Pleasant, southeast to Charleston, W. Va., 57 miles. *Weston & Buckhannon.*—Track laid from Weston, W. Va., eastward 2 miles, guage 3 ft. This is a total of 59 miles, making 10,534 miles so far reported for 1882. New track is reported laid in the present year as follows: *Eureka Springs.*—Extended from White River east by south to Eureka Springs, Ark., 7 miles. *Indiana, Illinois & Iowa.*—Extended eastward to Sugar Creek, Ind., 6 miles. This is a total of 13 miles, making 36¼ miles thus far reported for 1883, against 39 miles reported at the corresponding time in 1882, and 47 miles in 1881.

MEXICAN NATIONAL.—Engineers of the Mexican Government have inspected the Mexican National Railroad from Santa Coterina to Garcia, 32 kilometres, and accepted the same.

JONESBORO & CAPE GIRARDEAU.—This company has been organized to build a railroad from Jonesboro, Ill., southwest to Mississippi opposite Cape Girardeau, Mo. The distance is about 20 miles.

DELAWARE RIVER & LANCASTER.—The contractors for grading this road between Phœnixville, Pa., and the Falls of French Creek, have begun work in South Coventry township, near Pottstown.

CHICAGO & WEST MICHIGAN.—Surveys are being made for an extension of the Hart Branch from Hart, Mich., northward. The line is to be run as far as Manistee, about 35 miles from Hart.

HOT SPRINGS.—It is stated that this company, whose line is now about 20 miles long, from Hot Springs, Ark., to the Iron Mountain road at Malvern, is having a survey made for an extension from Malvern to the Texas & St. Louis road near Pine Bluff. The distance is about 55 miles.

ST LOUIS ELEVATED & RAPID TRANSIT RAILWAY.—A company by this name has been organized under the general railroad law of Missouri. The company proposes to construct a railroad from a point in St. Louis, near the intersection of Fifth and Walnut streets, westwardly to the city limits near the northwest corner of Forrest Park, with branches northwardly and southwardly. The length of these lines would be about 20 miles.

The capital stock is $200,000. The following are the incorporators and subscribers to the stock who subscribe for 20 shares each: Ex-President U. S. Grant, A. W. Sopher, F. K. Hain, R. I. Sloan, F. A. Marquand, Duncan D. Parmelee, John F. Dillon, New York; Adolphus Bonzano, Phœnixville, Pa.; Henry Wheeler, Philadelphia; Geo. W. Allen, John G. Priest, O. D. Tucker, R. C. Kerens, W. D. Griswold, and John W. Norton, St. Louis.

THE SEVERN TUNNEL.—The tunnel works have progressed without interruption during the past year. The length of arch already turned is 7,000 ft., and the progress in the last three months has averaged 500 ft. per month. There are four shafts used exclusively for winding, three shafts for winding and pumping combined, and four shafts for pumping only. There are eleven 15-in. pumps, four 18-in., two 26-in., two 28-in., and one 35-in., and the quantity of water raised daily is nearly 12,000,000 gallons. Only about half the pumps are continuously working, the others being held in reserve. The tunnel when completed will be 4½ miles long, 2½ under the river Severn, and two miles under the land. The strata under the river are now all hard and sound. The loose ground on the Gloucestershire side has all been bricked. Less water enters the works in the part under the river than in that under the land. The brickwork is executed in vitrified Cattybrook or Staffordshire bricks set in Portland cement. The number of bricks used weekly has risen to 500,000, equal to 26,000 000 a year. The number of men employed is about 3,000, for whom about 300 large and commodious houses have been built. 14,000 lbs. of explosives are used per month. Perfect ventilation is obtained by a Guibal fan and four Baker's blowers, and six air compressors are always at work, supplying air at 60 lb. pressure to the drills and pumps.

HARTFORD, NEW YORK & BOSTON R. R. SCHEMES.—A statement of the parallel railroad situation in Connecticut will show the character of the enterprises which have been begun, to afford additional facilities for transit between New York and Boston. The existing general railroad law of Connecticut was passed in 1871, and as since amended is in substance as follows: Not less than 25 persons may found a company. Articles of association must be filed with the Secretary of State and give the amount of capital stock, which shall not be less than $10,000 a mile for every mile of road to be constructed; a detailed report of surveys, &c., and before filing at least $5,000 of stock per mile must be subscribed and 10 per cent. paid in cash thereon. The company shall not begin the construction of its road until at least $10,000 a mile is subscribed by responsible persons. After the approval of the location by the Railroad Commissioners land may be taken during a period of two years; navigable waters may be bridged whenever a sworn statement is filed that there has been expended in the construction of the road a sum equal to $10,000 a mile within this State between either terminal points in the location of the road and the proposed bridge location; bonds may be issued to an amount not exceeding 50 per cent. of the amount actually expended upon the road, but no other railroad company shall subscribe for or hold any stock or bonds of any road thus organized.

The first application filed was in February, 1874, by the New York & Eastern Railway Company, composed of Connecticut stockholders entirely, with Samuel E. Olmstead, of Norwalk, as chief organizer. It was for a double track road between New York and New Haven. The capital was placed at $4,000,000, and the estimated cost at $6,000,000. At that time the law required application to be made to the Legislature to bridge navigable waters, and the company applied for the special privilege, which was denied, but the law was amended to cover bridging as given in the above abstract. This ended that enterprise. In October, 1879, Mr. Olmstead and his associates filed articles incorporating the Connecticut & Eastern road. With them were two New York City shareholders—J. C. Sidell, with 1,000 shares, and T. Nichol Browne, with 865 shares. Nothing was done by this company, and in September, 1880, new articles of association were filed. Mr. Olmstead still being an active mover. The capital stock was increased this time to $5,000,000, and the estimated cost of the road to $5,500,000. No shareholder subscribed for more than 300 shares. In the list were the following named New York City subscribers: C. V. Sidell, Sheldon Collins, H. C. Hepburn, Cyrus H. Loutrel, W. G. Black, Charles D. Ingersoll, H. Cummins, H. Walter Webb, Francis W. Ford, James E. Chandler, R. W. Larmbew, and Thomas M. Browne. This scheme fell through, and in October, 1881, Mr. Olmstead and Connecticut men principally, organized the New York & Connecticut Air Lane Railway Company, with a capital of $6,000,000, but presented estimates for a single track only, which amounted to $3,750,000. This enterprise is still pending, and the Railroad Commissioners have assigned a hearing for the 31st of the present month to consider the proposed route.

Meantime, the Hartford and Harlem Railway Company has filed its papers and asked the Legislature to give it consolidation privileges and authorize it to make an issue of bonds. Upon this a hearing is to be had before the Railroad Committee to-morrow afternoon, when the whole scheme will probably be developed. As to building under the general law, the company may be embarrassed by the prior application of the Air Line Company above referred to. The engineer's report of the Hartford & Harlem Company estimates the entire cost of the road at $8,170,581.26, the following items appearing: Road-bed, bridges, etc., $4,893,722.90; tracks, $1,637,858.36; buildings, including 22 stations, $249,000; equipment—60 passenger cars, 10 mail and baggage cars, 80 box cars, and 40 flats—$570,000; right of way—Stanford $100,000; Norwalk, $90,000; Bridgeport, $125,000; New Haven, $130,000; Meriden and South Meriden, $35,000, 850 acres of land at $400, $340,000—making a total for this outlay of $820,000. Last year a charter for a parallel road was repressed by the Legislature on the application of Marshall Jewell and others, and that scheme has dropped out of sight, none of its proprietors having any apparent interest in the new enterprise.

One more scheme is pending, that of the so-called New York and Boston Inland Company. Now, as last year, the claim in Massachusetts is that this alleged road has a "charter" from Connecticut. All the franchise it possesses here is what it may possibly possess hereafter by conforming to the railroad law. It has only so far filed an application, dated Feb. 4, 1882, and the report of its engineers is very brief. Upon an examination of the papers in the Secretary of State's office the enterprise does not assume magnificent proportions, except as a paper scheme. The capital stock is placed at $10,000,000. George Cook, of New Haven, subscribes for five shares, and his fellow-townsmen for three shares each, as follows: Geo. E. Spare, W. E. Weld, Jr., C. B. Adams, N. W. Merwin, Hugh Galbraith, John B. Adriance, Henry Lines, Samuel N. Beecher, Owen Kean, W. G. Cooke, F. A. Gilbert, E. S. Kimberly, Samuel W. Hurlburt, A. H. Cargill, and F. B. Olmstead. The other shareholders are E. N. Shelton, Isaac P. Howe, W. C. Atwater, H. A. Nettleton, W. B. Wooster, C. B. Booth, C. H. Coe, Henry Somers, H. S. Sawyer, of Birming-

ham, and J. D. Bristol, of Southington. Here are in all 80 shares subscribed for by 26 Connecticut people, who are not generally known and none of whom have ever been suspected of being large capitalists, and these are all of the subscribers, with a single exception, this being, as entered, "the New York Construction Company, Boston, by A. W. Boardman, its Treasurer, duly authorized by vote of the Directors, 6,120 shares." Two engineers furnish estimates of cost. From the New York State line to Middletown, on the Connecticut River, the amount given is $10,000,000; from Middletown to the Massachusetts State line in the town of Thompson, $8,250,000. Here are $18,250,000 for Connecticut alone, upon which speculators can, perhaps, figure the additional millions which it will take to construct the whole line.—*N. Y. Times.*

AUGUSTA, ELBERTON & CHICAGO R. R.—Mr. C. S. Dwight, of Columbia, S. C., has just returned from a reconnaisance of the above projected line, and the survey will be commenced immediately.

FORT SCOTT & WICHITA RAILROAD.—This road is now in running order from Fort Scott to El Dorado, Kan. But 30 miles more are needed to finish the road. During November 25 miles were built.

TOPEKA, KAN., COURT HOUSE.—Bids for sheet copper for the new Court House and Post Office at Topeka, Kan., were opened at the Treasury recently. Park, Scott & Co., of Pennsylvania, were the lowest bidders.

DELAWARE RIVER & LANCASTER R. R.—The contract to build 47 miles of road from Lancaster to Springfield has been let to Laman, Walker & Co., of this city.

THE AUGUSTA & KNOXVILLE R. R.—The stockholders have authorized the directors to sell or lease the road on the most favorable terms. It is opened 70 miles, from Augusta to Greenwood, S. C.

MT. VERNON & TAMAROA R. R.—This road is intended as a connecting link between the St. Elmo, Kaskaskia & Southern, for which much of the right of way has already been obtained, and the St. Louis & Southeastern. It is the company's intention to commence the survey and location of the line immediately.

GILMAN, STATE LINE & ROCHESTER RAILROAD CO. INCORPORATED.—This company has filed articles in Illinois. The proposed road is to be constructed from Gilman, in Iroquois County, Ill., to the State line between the States of Illinois and Indiana on the east line of Iroquois County, to connect with a railroad to be constructed from Rochester, in the State of Indiana, through Rensalaer, in the State of Indiana, to said State line on the east line of said Iroquois County, and to run in a northeastern direction from Gilman to State line. Capital stock, $500,000. Incorporators: Paul H. Dennis, Chicago; John Shule, James H. Allen and Elias Wenger, Gilman; John Lee, Rochester, Ind.; A. D. Ioner, Kewana, Ind., and Frank E. Newton, of Litchfield, Ill.

A SUMMARY OF NORTHWESTERN PROJECTS.—From Moorhead north a road is being built which is to run on the east side of the Red River, developing a section of the country between that stream and the Winnipeg line of the Manitoba road, upon which iron will be laid during the coming season. A road is projected on the west side of the Red River to stretch along the banks of that stream from here to Grand Forks.

The Manitoba road is pushing its Fargo & Grand Forks Extension northward from Grafton, and will soon be ready to connect with the Manitoba & Southwestern from Winnipeg at the boundary line. The Larimore extension is being pushed out toward the Devil's Lake country, and during the coming summer will reach Creelsburg, on the north shore of that lake, bringing into connection with the outer world a section of country said to be unrivaled for fertility.

The Manitoba Road is building a branch from Sydney to Casselton, connecting the Breckenridge, Hope and Portland extension with the Mayville Branch, and trains are now running thereon. The Manitoba Road has in contemplation another line running from Ripon, about thirty-five west from Fargo, where the Hope & Portland Road branches diverge, and this projected line will cross the Mayville branch in the vicinity of Amenia, and come into Fargo either directly or upon the Grand Forks extension three or four miles north of the city, near the Sheyenne.

Surveys have been made for the Grand Forks & Missouri Valley Railroad, crossing the Northern Pacific at Oriska, and work is to be commenced thereon in early spring time.

The Fargo Southwestern Branch of the Northern Pacific has been completed, and trains are running to Lisbon, fifty-five miles south of Fargo. This road will be continued westward, through Ransom and La Moure Counties, to Grand Rapids, on the James River, during the coming season.

The Northern Pacific, having secured the Wahpeton Western extension from the Manitoba road, is now laying track through Richland County, directly west. Iron is said to be down thirty or forty miles west of the Red River Valley. This road will be continued to some point on the Jim River, where it will probably connect with the Fargo Southwestern, the two uniting to make a single line of road to the Black Hills.

The Jamestown Northern extension of the Northern Pacific road is built out some forty miles, and will probably go to some point yet to be named on Devil's Lake, where the railroad system will center and make a large city.

The Sanborn, Cooperstown & Turtle Mountain Railroad, controlled by local capitalists, has been built by General Manager Charles A. Roberts, of Fargo, and trains are running some ten or fifteen miles. Track laying will continue to Cooperstown, forty miles, as rapidly as work can be finished.

The Fargo & Southern Railroad has been graded thirty-five miles south of Fargo, and iron will be placed upon the same in the spring.

Several other lines have been projected and some will be in operation before the close of 1883.

There is probably no section of the United States that is so covered by a net-work of railroads as North Dakota, taking into consideration the time the country has commenced to boom. It will be surprising to those who understand the situation to be assured that over 1,000 miles of rails will be laid in North Dakota and the Red River Valley during the year.—*Fargo (Dak.) Argus.*

GAS STATISTICS OF RICHMOND, VA.—Forty-eight miles of street mains; 1235 street lamp; 123,117,694 cubic ft. consumed last year; price, $2; the works are estimated to be worth $1,250,000; excess of receipts over expenditures, $27,598.

INDIANAPOLIS BRIDGE CO.—This company has been incorporated under the laws of Indiana—capital $100,000.

WORCESTER (MASS.) NEW WATER SUPPLY.—The council has voted to take Talmuck Brook, one of the tributaries of the Blackstone River, for an additional water supply. The stream will furnish twice as much water as is now available from the present sources. The cost will be from $300,000 to $400,000.

UTAH CENTRAL.—A thorough inspection is being made of this road, especially the bridges, and the whole line is being put in first-class order.

MEMPHIS & VICKSBURG ROAD.—Three thousand tons of steel rails have been delivered, and 4,000 are *en route* between Vicksburg and Memphis. The general manager reports that 500 men are at work on the road. He expects to soon let contracts for three more bridges on the line between Vicksburg and Memphis, exclusive of that now being built across the Yazoo.

OBLIGATION OF A CITY TO SUPPLY PURE WATER.—It must not be forgotten that the obligation of a city to supply pure water is one recognized by the law. Huddersfield, a small place in England, found itself cast last August in damages to the amount of $10,000, awarded in an action brought by a man whose health had suffered from unwholesome water.—*Philadelphia Press.*

BRIDGING THE RIO GRANDE AT EAGLE PASS.—All the material and machinery for building the bridge is on hand, and the force will be organized and begin work immediately.

BRANCH OF THE ST. LOUIS & IRON MOUNTAIN.—A survey has been commenced of a branch from Little Rock to Hot Springs.

CONTRACT LET FOR WATER MAIN.—The contract for the new water main in the Eastern District, Brooklyn, N. Y., has been awarded to Mellert Foundry and Machine Co., of Reading, Penn., and that for special castings for the main to A. H. McNeal, of Burlington, N. J., at an aggregate of $140,000. This is $30,000 less than the estimate made several months ago, and is due to the depression of the iron trade.

ST. LOUIS BUILDING STATISTICS.—The estimated value of all the improvements during last year is $5,385,072, which is nearly $1,000,000 in excess of the previous year. The total number of building permits issued during the year was 2,361, of which 715 were for frame structures. The outlook for the present year is good.

MEADOW VALLEY R. R. CO.—The directors of this company have elected officers. The road will be narrow gauge, and will run from Hazen to Arkansas City, Ark. Offices are at Little Rock, Ark.

ELECTRICAL TRANSMISSION OF POWER.—A novel application of the electrical transmission of power has lately been made at the Trafalgar collieries, Forest of Dean. The electrical arrangements were carried out by the Pyramid Electric Company, under the supervision of their managing director, Mr. A. Le Neve Foster. In this case an electric motor is used to drive a pump in the underground workings. The pump is employed for pumping the drainage water from some of the deep workings to the bottom of the shaft, whence the ordinary steam pumps raise it to the surface. The total vertical lift of the electric pump is 115 ft., while the length of pipes through which the water is forced is some 500 yards. A dynamo machine is placed on the surface for generating the current for working the motor, and is connected to it by wires led down the shaft and along the workings, a distance of some 500 yards. Messrs. Prain, the proprietors of the collieries, express themselves perfectly satisfied with the result of the undertaking, and propose still further to extend the utilization of electricity as a motive power.—*Journal of the Society of Arts, London.*

MCMAHAN, PORTER & CO., NEW CUMBERLAND, W. VA., JAN. 17, 1883.—On Thursday, the 4th inst., two of our boilers exploded, completely wrecking part of the works. A portion of our machinery is uninjured, however, and more than half of the shop can soon be repaired, so that in a short time we can commence making pipe again. We will rebuild at once and hope to soon have our works as large as before. We have a good stock on hand and arrangements made by which we can fill orders promptly. Thanking you for past favors and soliciting a continuance of the same, we are,

Respectfully, MCMAHAN, PORTER & CO.

NEW MOTOR FOR STREET CARS.—Mr. B. B. Pole, of Philadelphia, has invented a motor which is claimed will operate economically and surely.

THE HEATHEN ERA.—J. T. Fanning, the hydraulic engineer, delivered, on the 18th inst., at Manchester, N. H., a lecture on "Skill and Art in the Heathen Era."

ANNUAL TOUR OF THE THAYER SCHOOL OF CIVIL ENGINEERING.—The students of the above institute, accompanied by Prof. R. Fletcher, and Mr. C. S. Cook, of the Chandler Scientific School, made a very successful and profitable trip to Boston and vicinity Dec. 26 to Jan. 2, inclusive, for the purpose of examining various works, instruments and machinery of interest to engineers. A printed report to the President of Dartmouth gives quite an interesting account of how the time was spent.

PENNSYLVANIA R. R. CONSTRUCTION.—Unusual activity prevails in railroad construction in Pennsylvania. Several trunk lines are building branches and connections to develop the coal, ore, lumber, oil and coke regions of this state. The Vanderbilt interest has a thousand men at work on a road connecting Williamsport, Clearfield and Reading with his system of lines. This branch passes through a country abounding with lumber and mineral resources, which will by this avenue be brought within the reach of market, and it is said that Vanderbilt and other capitalists have made purchases of large tracts of land for purposes of development and speculation. The Pennsylvania company is also engaged in building extensions into the rich mineral fields of the state. The Baltimore & Ohio company is constructing branches in the southern part of the commonwealth to make connection with Harrisburg, Reading, and thence to New England points. In the western part of the state the same company is making connection with Pittsburgh, and Wheeling by new and shorter routes. Pennsylvania is developing its mineral and timber resources rapidly. Manufacturers are seeking new sites for plants, and lumbermen are purchasing tracts of timber and enlarging their operations. Every addition of railway facilities starts up a number of such enterprises, that are backed by a strength of capital unknown a few years ago.

NEW COURT HOUSE AT TIFFIN, O.—The County Commissioners have entered into an agreement with E. E. Myers, architect of Detroit, Mich., to furnish plans and specification for a new court house, to be erected at Tiffin. The cost must not exceed $135,000.

THE SOUTH PENNSYLVANIA R. R.—Mr. Vanderbilt is quoted as saying that the cost of the South Pennsylvania was estimated at $100,000 a mile, and there was about 200 miles of road to build. The line did not come so particularly in competition with the Pennsylvania. It lay fifty or sixty miles away for the most part, and would develop business for itself in the country through which it ran. Mr. Vanderbilt alluded to the profits in the local traffic, from which the Pennsylvania and the Baltimore & Ohio had secured great returns.

APPLIED MATHEMATICS.

VANDERBILT UNIVERSITY,
NASHVILLE, TENN., Jan. 20.

EDITOR ENGINEERING NEWS:

I notice in your extract from my *circular of instruction for finding the true meridian* on page 24, vol. X., the following errors:

In table I., last column, top line, read 12h 34.6m A. M. instead of 12h 24.0m A. M.

In lines 11 and 12, below table, read "3.5*m* *for each year*" instead of 35*m* *for each year*.

In line 20, below table, read ".14*m* *for each degree*" instead of 14*m* *for each degree*.

In line 21, below table, read ".18*m* *for each degree*" instead of 18*m* *for each degree*.

Yours truly, OLIN H. LANDRETH.